User's
Manual

DL850E/DL850EV
ScopeCorder
Getting Started Guide

YOKOGAWA
Yokogawa Meters & Instruments Corporation

IM DL850E-03EN
1st Edition

Product Registration

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Thank you for purchasing the DL850E ScopeCorder or DL850EV ScopeCorder Vehicle Edition (hereinafter, “DL850E/DL850EV” will refer to both of these products).
This getting started guide primarily explains the handling precautions and basic operations of the DL850E/DL850EV. To ensure correct use, please read this manual thoroughly before operation.
Keep this manual in a safe place for quick reference in the event that a question arises.
This manual is one of six DL850E/DL850EV manuals. Please read all manuals.

Manual Title	Manual No.	Description
DL850E/DL850EV ScopeCorder Features Guide	IM DL850E-01EN	The supplied CD contains the PDF file of this manual. This manual explains all the DL850E/DL850EV features other than the communication interface features. You can view the same information in the DL850E/DL850EV help files.
DL850E/DL850EV ScopeCorder User’s Manual	IM DL850E-02EN	The supplied CD contains the PDF file of this manual. The manual explains how to operate the DL850E/DL850EV.
DL850E/DL850EV ScopeCorder Getting Started Guide	IM DL850E-03EN	This manual. This guide explains the handling precautions and basic operations of the DL850E/DL850EV.
DL850E/DL850EV ScopeCorder Communication Interface User’s Manual	IM DL850E-17EN	The supplied CD contains the PDF file of this manual. The manual explains the DL850E/DL850EV communication interface features and instructions on how to use them.
DL850E/DL850EV ScopeCorder Real Time Math/Power Math User’s Manual	IM DL850E-51EN	The supplied CD contains the PDF file of this manual. This manual explains the features of the DL850E/DL850EV Real Time Math/Power Math option and how to use them.
DL850E/DL850EV ScopeCorder Acquisition Software User’s Manual	IM DL850E-61EN	The supplied CD contains the PDF file of this manual. This manual explains all the features of the acquisition software, which performs continuous measurement on the DL850E/DL850EV.

Notes

- The contents of this manual are subject to change without prior notice as a result of continuing improvements to the instrument’s performance and functions. The figures given in this manual may differ from those that actually appear on your screen.
- Every effort has been made in the preparation of this manual to ensure the accuracy of its contents. However, should you have any questions or find any errors, please contact your nearest YOKOGAWA dealer.
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Revisions

- 1st Edition: December 2013

Regarding the Conventional DL850/DL850V

The DL850E/DL850EV manuals also cover how to use the conventional DL850/DL850V (firmware version 3.0 and later).
In the explanations, the model is indicated as DL850E/DL850EV, but if you are using the DL850/DL850V, read “DL850E/DL850EV” as “DL850/DL850V.”
Note that the following options are available only for the DL850E/DL850EV. They cannot be used with the DL850/DL850V.

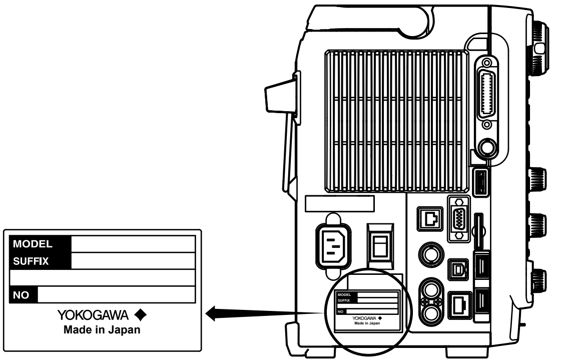
- Power math (/G5 option)
- GPS interface (/C30 option)

Checking the Contents of the Package

Unpack the box, and check the contents before operating the instrument. If the wrong items have been delivered, if items are missing, or if there is a problem with the appearance of the items, contact your nearest YOKOGAWA dealer.

DL850E/DL850EV

Check that the product that you received is what you ordered by referring to the model name and suffix code given on the name plate on the left side panel.



MODEL	Suffix Code	Description
DL850E/DL850EV		Main device, 8 slots, 250 Mpoint memory
Power cord[1]	-D	UL/CSA Standard power cord (Part No.: A1006WD) [Maximum rated voltage: 125 V]
	-F	VDE Standard Power Cord (Part No.: A1009WD) [Maximum rated voltage: 250 V]
	-Q	BS Standard Power Cord (Part No.: A1054WD) [Maximum rated voltage: 250 V]
	-R	AS Standard Power Cord (Part No.: A1024WD) [Maximum rated voltage: 250 V]
	-H	GB Standard Power Cord (Part No.: A1064WD) [Maximum rated voltage: 250 V]
Language	-HJ	Japanese
	-HE	English
	-HC	Chinese
	-HK	Korean
	-HG	German
	-HF	French
	-HL	Italian
	-HS	Spanish
Options	/B5	Built-in printer[2]
	/DC	12 VDC Power (10 to 18 VDC) (DL850EV only)[3]
	/M1	Memory expansion to 1 Gpoint[4]
	/M2	Memory expansion to 2 Gpoint[4]
	/HD0	External HDD interface[5]
	/HD1	500 GB internal HDD[5]
	/C1	GP-IB interface[6]
	/C20	GP-IB interface + IRIG[6]
	/C30	GPS interface[6]
	/G2	User-defined computation
	/G3	Real Time Math
	/G5	Power math[7]
	/P4	Probe power supply, four outputs

[1] Make sure that the attached power cord meets the designated standards of the country and area that you are using it in.

[2] Includes one roll of paper (B9988AE)

[3] The /DC option can only be installed on the DL850EV. The /DC and /B5 options cannot be installed on the same instrument.

[4] The /M1 and /M2 options cannot be installed on the same instrument.

[5] The /HD0 and /HD1 options cannot be installed on the same instrument.

[6] The /C1, /C20, and /C30 options cannot be installed on the same instrument.

[7] The /G3 and /G5 options cannot be installed on the same instrument.

No. (Instrument Number)

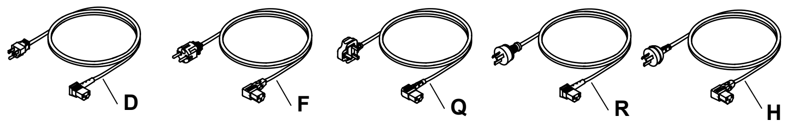
When contacting the dealer from which you purchased the instrument, please give them the instrument number.

Standard Accessories

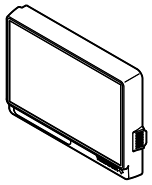
The standard accessories below are supplied with the instrument. Check that all contents are present and undamaged.

Item	Model or Part No.	Quantity	Specifications and Notes
Power cord[1]	A1006WD	1	UL, CSA, and PSE standard
	A1009WD		VDE standard
	A1054WD		BS standard
	A1024WD		AS standard
	A1064WD		GB standard
Front-panel protection cover	B8074EA	1	—
Soft case	B8059GG	1	—
Printer roll paper[2]	B9988AE	1	—
Panel sheet	See below.	1	Japanese, Chinese, Korean, German, French, Italian, or Spanish
DC power connector[3]	B8023WZ	1	—
Cover panels	B8073CY	8	—
Rubber feet	B9989EX	1	—
GPS antenna[4]	A1058ER	1	—
Manuals			
Printed manuals	IM DL850E-03EN	1	Getting Started Guide (this guide)
	IM DL850E-92Z1	1	Document for China
CD	B8074XT	1	Contains PDFs of the user's manuals, Acquisition Software and USB driver (For the types of manuals that CD contains, see the next page.)

Power Cord (one of the following power cords is supplied according to the instrument's suffix codes)[1]


UL/CSA Standard A1006WD
VDE Standard A1009WD
BS Standard A1054WD
AS Standard A1024WD
GB Standard A1064WD

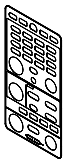
Front-panel protection cover B8074EA



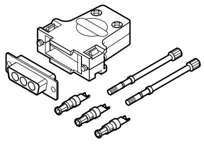
One of the following panel sheets:

DL850E
B8074GP (Japanese; -HJ)
B8074GQ (Chinese; -HC)
B8074GR (Korean; -HK)
B8074GS (German; -HG)
B8074GT (French; -HF)
B8074GV (Italian; -HL)
B8074GW (Spanish; -HS)

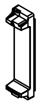
DL850EV
B8074HP (Japanese; -HJ)
B8074HQ (Chinese; -HC)
B8074HR (Korean; -HK)
B8074HS (German; -HG)
B8074HT (French; -HF)
B8074HV (Italian; -HL)
B8074HW (Spanish; -HS)



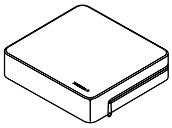
DC power connector[3] B8023WZ



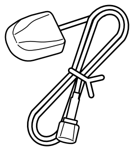
Cover panels B8073CY, 8 panels



Soft case B8059GG

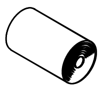


GPS antenna[4] A1058ER

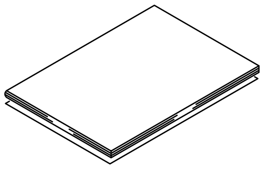


Rubber feet B9989EX, 1 sheet (4 feet)

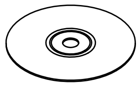
Printer roll paper[2] B9988AE, 1 roll



Manuals
- Printed manuals



- CD



[1] Make sure that the attached power cord meets the designated standards of the country and area that you are using it in.
[2] Only included with models that have a built-in printer (/B5)
[3] Only included with DL850EVs that have the 12 VDC power supply (/DC option)
[4] Only included with models that have a GPS interface (/C30)

Accompanying CD

The Manuals/English folder in the accompanying CD contains the PDF files shown below. The CD also contains Japanese manuals.

File Name	Manual Title	Manual No.
Real Time Math & Power Math.pdf	DL850E/DL850EV ScopeCorder Real Time Math/ Power Math User's Manual	IM DL850E-51EN
Features Guide & Users Manual.pdf	DL850E/DL850EV ScopeCorder Features Guide	IM DL850E-01EN
	DL850E/DL850EV ScopeCorder User's Manual	IM DL850E-02EN
Communication Interface.pdf	DL850E/DL850EV ScopeCorder Communication Interface User's Manual	IM DL850E-17EN
Acquisition Software.pdf	DL850E/DL850EV ScopeCorder Acquisition Software User's Manual	IM DL850E-61EN

To view the PDF files above, you need Adobe Reader 5.0 or later.

WARNING

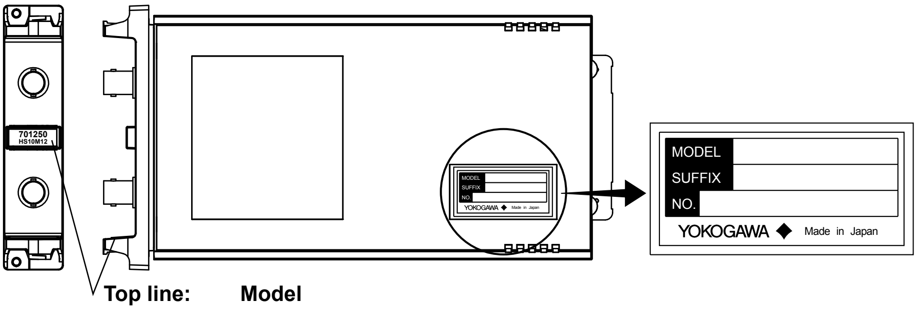
Never play this accompanying CD, which contains the user's manuals, in an audio CD player. Doing so may cause loss of hearing or speaker damage due to the large sounds that may be produced.

Input Modules (Sold Separately)

To make sure that an input module is the module that you ordered, check the module name written on it.

MODEL	Name	Abbreviation
701250	High-Speed 10 MS/s, 12-Bit Isolation Module	HS10M12
701251	High-Speed High-Resolution 1 MS/s, 16-Bit Isolation Module	HS1M16
701255	High-Speed 10 MS/s, 12-Bit Non-Isolation Module	NONISO_10M12
701267	High-Voltage 100 kS/s, 16-Bit Isolation Module (with RMS)	HV (with RMS)
701261	Universal (Voltage/Temp.) Module	UNIVERSAL
701262	Universal (Voltage/Temp.) Module (with AAF)	UNIVERSAL(AAF)
701265	Temperature, High Precision Voltage Isolation Module	TEMP/HPV
701270	Strain Module (NDIS)	STRAIN_NDIS
701271	Strain Module (DSUB, Shunt-Cal)	STRAIN_DSUB
701275	Acceleration/Voltage Module (with AAF)	ACCL/VOLT
701280	Frequency Module	FREQ
720210	High-Speed 100 MS/s, 12-Bit Isolation Module	HS100M12
720220	16-CH Voltage Input Module	16CH VOLT
720221	16-CH Temperature/Voltage Input Module	16CH TEMP/VOLT
720230	Logic Input Module	LOGIC
720240	CAN Bus Monitor Module*	CAN MONITOR
720241	CAN & LIN Bus Monitor Module*	CAN & LIN

* The CAN bus monitor module and CAN & LIN bus monitor module can be used on the DL850EV. It cannot be used on the DL850E.



Top line: Model
Bottom line: Abbreviation
The location varies depending on the module.

In this manual, input modules are referred to by their model names and abbreviations.
For example, the High-Speed 10 MS/s, 12-Bit Isolation Module is referred to as the 701250 (HS10M12). However, if a module has already been referred to previously, it may be referred to only by its model name (for example, 701250).

Note

To use the DL850E/DL850EV with 701250 and 701255 modules shipped between August 2006 and June 2007, you must update the module firmware. If error code 916 appears when you turn on the DL850E/DL850EV, it may be necessary to update the firmware of the aforementioned modules. Prepare the module serial numbers, and contact your nearest YOKOGAWA dealer. The dealer will update the module firmware for a fee.

Optional Accessories (Sold Separately)

The optional accessories below are available for purchase separately. Check that all contents are present and undamaged. For information about ordering accessories, contact your nearest YOKOGAWA dealer.

Name	Model	Safety standard[1]	Note
Isolated probe	700929	1000 Vrms CAT II	10:1 safety probe for the 701250, 701251, and 720210
	701947	1000 Vrms CAT II	100:1 safety probe for the 701250, 701251, and 720210
Current probe	701933	300 Vrms	30 Arms, DC to 50 MHz. Used by connecting to a probe power terminal (/P4 option) or a probe power supply (701934; sold separately).
	701930	300 Vrms CAT III	150 Arms, DC to 10 MHz. Used by connecting to a probe power terminal (/P4 option) or a probe power supply (701934; sold separately).
	701931	300 Vrms CAT III	500 Arms, DC to 2 MHz. Used by connecting to a probe power terminal (/P4 option) or a probe power supply (701934; sold separately).
10:1 passive probe	701940	—	For non-isolated input on the 701255: 600 V or less For isolated input other than above: 42 V or less
Differential probe	700924	1000 Vrms CAT III[2]	Switchable between 1000:1 and 100:1 Measurable voltage: 1400 Vpeak (1000 Vrms)
	700925	1000V(DC+AC peak) CAT III	Switchable between 100:1 and 10:1 Measurable voltage: 500 Vpeak (350 Vrms)
	700926	1000 Vrms CAT III	Switchable between 1000:1 and 100:1 Measurable voltage: 7000 Vpeak (5000 Vrms)
1:1 BNC safety adapter lead	701901	1000 Vrms CAT II	For use with the 701250, 701251, and 720210. Used with the following items (which are sold separately): the 701954, 701959, 758922, 758929, or 758921.
Measurement lead	758933	1000 Vrms CAT III	1 m in length; for use with the 701267. Used with the following items (which are sold separately): the 701954, 701959, 758922, 758929, or 758921.
Alligator clip (dolphin type)	701954	1000 Vrms CAT III	Two pieces in one set (red/black)
Safety mini-clip (hook type)	701959	1000 Vrms CAT II	Two pieces in one set (red/black)
Alligator clip adapter	758922	300 Vrms CAT II	Two pieces in one set
Alligator clip adapter	758929	1000 Vrms CAT II	Two pieces in one set
Fork terminal adapter	758921	1000 Vrms CAT II	Two pieces in one set (red/black). For 4 mm screws.
Cable[3]	366926	—	For measuring low voltage of less than or equal to 42 V
Banana–alligator clip cable	366961	—	For measuring low voltage of less than or equal to 42 V for the 701261, 701262, or 701265
High-speed logic probe	700986	—	42 V or less, 8 bits, non-isolated, response speed of 1 μs
Isolated logic probe	700987	250 Vrms CAT II	8 bits, each channel isolated, response speed of 20 ms (for AC)
1 m logic probe	702911	—	8 bits, non-isolated
3 m logic probe	702912	—	8 bits, non-isolated
Isolated logic measurement lead	758917	1000 Vrms CAT II	Two pieces in one set. Used with the 758922 or 758929 adapter. The adapters are sold separately.
External I/O cable	720911	—	For external I/O
1 m safety BNC cable	701902	1000 Vrms CAT II	—
2 m safety BNC cable	701903	1000 Vrms CAT II	—
Safety BNC-to-banana adapter	758924	500 Vrms CAT II	For the 701250, 701251, 701255, and 720210
Probe power supply	701934	—	High current output power supply for external probes (four outputs)
Shunt resistor	438920	—	250 Ω ± 0.1%
	438921	—	100 Ω ± 0.1%
	438922	—	10 Ω ± 0.1%
16-CH scanner box	Accessory: Protection cover 1, Protection cover screw 1, Attaching plate 1, Binding screw 2		
	701953-L1	—	For the 720221; cable length: 1 m
	701953-L3	—	For the 720221; cable length: 3 m
Cable	705926	—	1 m in length; for connecting the 720221 and 701953
Cable	705927	—	3 m in length; for connecting the 720221 and 701953
Bridgehead	701955	—	NDIS, bridge resistance: 120 Ω
	701956	—	NDIS, bridge resistance: 350 Ω
	701957	—	DSUB, bridge resistance: 120 Ω, shunt-cal support
	701958	—	DSUB, bridge resistance: 350 Ω, shunt-cal support

Checking the Contents of the Package

Name	Model	Safety standard[1]	Note
Plug-on clip	701948	1000Vrms CAT II	For the 700929/701947
Long test clip	701906	1000Vrms CAT III	For the 700924/701926
Soft carrying case	701963		Has three pockets
DC power cord (Cigarette lighter plug type)	701970	—	For the DC power supply model (/DC)
DC power cord (Alligator clip type)	701971	—	For the DC power supply model (/DC)
GPS antenna	A1058ER	—	GPS interface model (/C30)

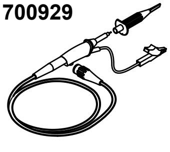
Sold individually.

1 The actual voltage that can be used is the lowest voltage of the DL850E/DL850EV and cable specifications.

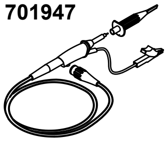
2 Be sure to connect the GND lead provided with the 700924 to the functional ground terminal of the DL850E/DL850EV. The connection of the GND lead makes 1400 Vpeak measurement possible.

3 Use cables (366926) that YOKOGAWA has been shipping since February 4, 1998. Cables (366926) shipped before this date cannot be used in combination with the DL850E/DL850EV input modules.

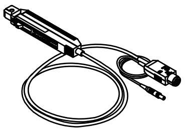
Isolated probe
700929



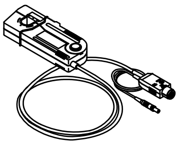
Isolated probe
701947



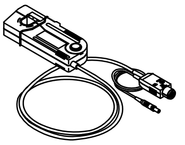
Current probe
701933



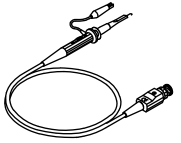
Current probe
701930



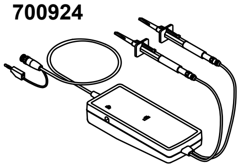
Current probe
701931



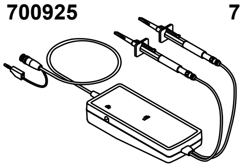
10:1 passive probe
701940



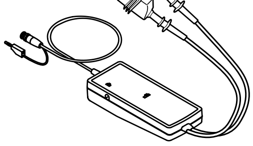
Differential probe
700924



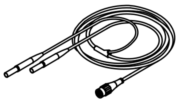
Differential probe
700925



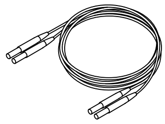
Differential probe
701926



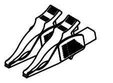
1:1 BNC safety
adapter lead
701901[1]



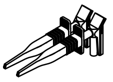
Measurement lead
758933[1]



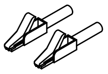
Alligator clip
(dolphin type)
701954



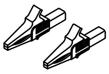
Safety miniclip
(hook type)
701959



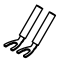
Alligator clip adapter
(rated 300 V)
758922



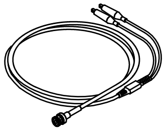
Alligator clip adapter
(rated 1000 V)
758929



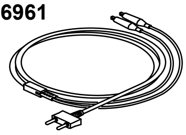
Fork terminal
adapter
758921



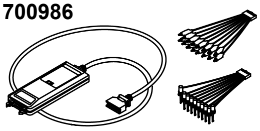
Cable
366926



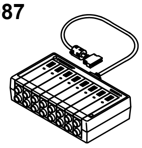
Banana–alligator
clip cable
366961



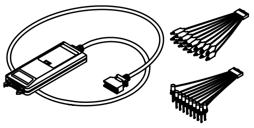
High-speed logic probe
700986



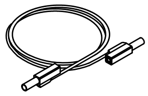
Isolated logic probe
700987



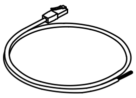
Logic probes
702911 (1 m)/702912 (3 m)



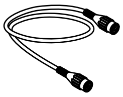
Isolated logic
measurement lead
758917



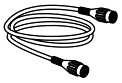
External I/O cable
720911



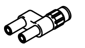
Safety BNC cable
(1 m) 701902



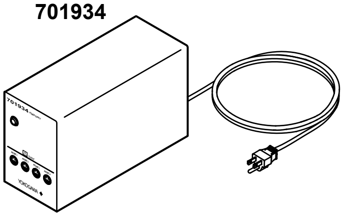
Safety BNC cable
(2 m) 701903



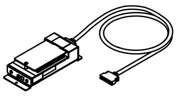
Safety
BNC-to-banana
adapter
758924



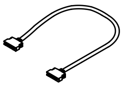
Probe power supply
701934



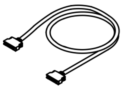
16-CH scanner box
701953[2]



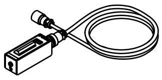
Cable
705926 (1 m)



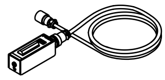
Cable
705927 (3m)



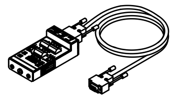
26. Bridgehead
701955 (NDIS, 120 Ω)



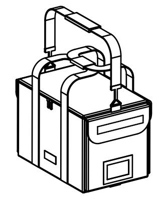
Bridgehead
701956 (NDIS, 350 Ω)



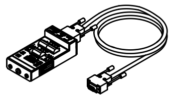
Bridgehead
701957 (DSUB, 120 Ω)



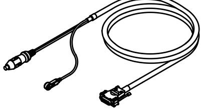
Soft carrying case
701963



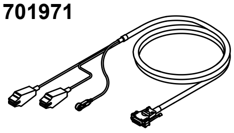
Bridgehead
701958 (DSUB, 350 Ω)



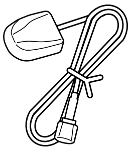
DC power cable
(Cigarette lighter plug type)
701970



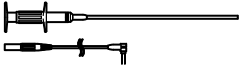
DC power cable
(Alligator clip type)
701971



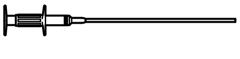
GPS antenna
A1058ER



Plug-on clip
701948



Long test clip
701906



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[1] The 1:1 BNC safety adapter lead (701901) and the measurement lead (758933) must be used with one of the following accessories (which are sold separately): alligator clip (dolphin type: 701954), safety miniclip (hook type: 701959), alligator adapter (758922 or 758929), or fork terminal adapter (758921).

[2] The length of the 16-CH scanner box (701953) cable varies depending on the 16-CH scanner box suffix code.

Spare Parts (Sold Separately)

The spare parts below are available for purchase separately. Check that all contents are present and undamaged.

For information about ordering spare parts, contact your nearest YOKOGAWA dealer.

Name	Part No.	Minimum Q'ty	Note
Printer roll paper	B9988AE	10	Thermo-sensitive paper, 111 mm × 10 m
Terminal block	A1800JD	1	For the 720220 input module

Safety Precautions

This instrument is an IEC safety class I instrument (provided with a terminal for protective earth grounding).
The general safety precautions described herein must be observed during all phases of operation.
If the instrument is used in a manner not specified in this manual, the protection provided by the instrument may be impaired. YOKOGAWA assumes no liability for the customer's failure to comply with these requirements.

The following symbols are used on this instrument.

⚠	Warning: handle with care. Refer to the user's manual or service manual. This symbol appears on dangerous locations on the instrument which require special instructions for proper handling or use. The same symbol appears in the corresponding place in the manual to identify those instructions.
⚡	Risk of electric shock
⏚	Protective ground terminal
⏚	Ground or the functional ground terminal (do not use as the protective earth ground terminal)
∼	Alternating current
|	ON (power)
○	OFF (power)

Failure to comply with the precautions below could lead to injury or death or damage to the instrument.

WARNING

Use the Instrument Only for Its Intended Purpose
This instrument is a waveform measuring device that monitors and measures electrical signals. Do not use this instrument for anything other than as a waveform measuring device.

Check the Physical Appearance
Do not use the instrument if there is a problem with its physical appearance.

Use the Correct Power Supply
Before connecting the power cord, ensure that the power supply voltage matches the rated supply voltage of the DL850E/DL850EV and that it is within the maximum rated voltage of the provided power cord.

Use the Correct Power Cord and Plug
To prevent the possibility of electric shock or fire, be sure to use the power cord supplied by YOKOGAWA. The main power plug must be plugged into an outlet with a protective earth terminal. Do not invalidate this protection by using an extension cord without protective earth grounding. Additionally, do not use the power cord supplied with this instrument with another instrument.

Connect the Protective Grounding Terminal
Make sure to connect the protective earth to prevent electric shock before turning on the power. The power cord that comes with the instrument is a three-prong type power cord. Connect the power cord to a properly grounded three-prong outlet.

Do Not Impair the Protective Grounding
Never cut off the internal or external protective earth wire or disconnect the wiring of the protective earth terminal. Doing so may result in electric shock or damage to the instrument.

Do Not Operate with Defective Protective Grounding or Fuse
Do not operate the instrument if the protective earth or fuse might be defective. Check the grounding and the fuse before operating the instrument.

Do Not Operate in an Explosive Atmosphere
Do not operate the instrument in the presence of flammable gasses or vapors. Doing so is extremely dangerous.

Do Not Remove the Covers or Disassemble or Alter the Instrument
Only qualified YOKOGAWA personnel may remove the covers and disassemble or alter the instrument. The inside of the instrument is dangerous because parts of it have high voltages.

Ground the Instrument before Making External Connections
Securely connect the protective grounding before connecting to the item under measurement or to an external control unit. Before touching a circuit, turn off its power and check that it has no voltage.

Precautions to Be Taken When Using the DC Power Supply (When using a DL850EV DC power supply model)

- Make sure to perform protective earth grounding to prevent electric shock.
- Connect the DC power cord after checking that the power switch of the instrument is turned OFF. If you connect the power cord with the power switch turned ON, sparks may be emitted and can lead to fire.

Precautions to Be Taken When Using the Modules

- Do not apply input voltage exceeding the maximum input voltage, withstand voltage, or allowable surge voltage.
- To prevent the possibility of electric shock, be sure to furnish protective earth grounding of the DL850E/DL850EV.
- To prevent the possibility of electric shock, be sure to fasten the module screws. Otherwise, the electrical protection function and the mechanical protection function will not be activated.
- Do not leave the instrument connected to devices in an environment that may be subject to voltage surges.

Precautions to Be Taken When Using the Probes

- When measuring high voltages using the 701250 (HS10M12) or 701251 (HS1M16), use an isolated probe (the 700929 or 701947), 1:1 safety cable (a combination of the 701901 and 701954), or differential probe (700924).
- Be sure to connect the GND lead of the differential probe (700924/700925/701926) to the functional ground terminal of the DL850E/DL850EV. High voltage may appear at the BNC connector of the differential probe. Also, be sure to connect the GND lead to the DL850E/DL850EV before you connect to the device under measurement.
- When using the 701255 (NONISO_10M12), be sure to fasten the module screws.
  Fastening the module screws activates the protection function and the non-isolation function. It is extremely dangerous if you do not fasten the screws. Also, when you measure high voltages above 42 V, be sure to use the passive probe (the 701940).
- The BNC portion of the passive probe (701940) is metal, so if you use it with isolated input (the 701250 (HS10M12), 701251 (HS1M16), etc.), for safety, be sure to only use it with voltages at or below 42 V.(Do not connect voltage above 42 V to both the High and Low sides.)
  For non-isolated inputs (701255 (NONISO_10M12), etc.), fasten the module screws as described before.
- When you apply high voltages to the 701267 (HV (with RMS)), use a measurement lead 758933 and alligator clip 701954.
- The measurement category of the 701267 (HV (with RMS)) is 400V-CAT II on the low side and 700V-CAT II on the high side. Use caution because the overvoltage tolerance differs between the low and high sides.

Measurement Category

The measurement category of this instrument’s signal input terminals varies depending on the modules that are installed. Use the instrument within the scope of the measurement category that corresponds to the module specifications. Do not use the instrument outside the scope of the measurement category that corresponds to the module specifications.

Installation Location

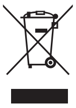
- This instrument is designed to be used indoors. Do not install or use it outdoors.
- Install the instrument so that you can immediately remove the power cord if an abnormal or dangerous condition occurs.

CAUTION

Operating Environment Limitations

This product is a Class A (for industrial environments) product. Operation of this product in a residential area may cause radio interference in which case the user will be required to correct the interference.

Waste Electrical and Electronic Equipment

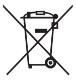


Waste Electrical and Electronic Equipment (WEEE), DIRECTIVE 2002/96/EC
(This directive is valid only in the EU.)
This product complies with the WEEE Directive (2002/96/EC) marking requirement. This marking indicates that you must not discard this electrical/electronic product in domestic household waste.

Product Category
With reference to the equipment types in the WEEE directive Annex I, this product is classified as a “Monitoring and control instruments” product.

Do not dispose in domestic household waste. When disposing products in the EU, contact your local Yokogawa Europe B. V. office.

New EU Battery Directive



New EU Battery Directive, DIRECTIVE 2006/66/EC
(This directive is valid only in the EU.)
Batteries are included in this product. This marking indicates they shall be sorted out and collected as ordained in ANNEX II in DIRECTIVE 2006/66/EC.

Battery type: Lithium battery

You cannot replace batteries by yourself. When you need to replace batteries, contact your local Yokogawa Europe B.V.office.

Symbols and Notation Used in This Manual

Unit

k: Denotes 1000. Example: 100 kS/s (sample rate)
K: Denotes 1024. Example: 720 KB (file size)

Displayed Characters

Bold characters in procedural explanations are used to indicate panel keys and soft keys that are used in the procedure and menu items that appear on the screen.

Notes and Cautions

The notes and cautions in this manual are categorized using the following symbols.

⚠	*Improper handling or use can lead to injury to the user or damage to the instrument*. This symbol appears on the instrument to indicate that the user must refer to the user's manual for special instructions. The same symbol appears in the corresponding place in the user's manual to identify those instructions. In the manual, the symbol is used in conjunction with the word "WARNING" or "CAUTION."
WARNING	Calls attention to actions or conditions that could cause serious or fatal injury to the user, and precautions that can be taken to prevent such occurrences.
CAUTION	Calls attentions to actions or conditions that could cause light injury to the user or damage to the instrument or user's data, and precautions that can be taken to prevent such occurrences.
Note	Calls attention to information that is important for proper operation of the instrument.

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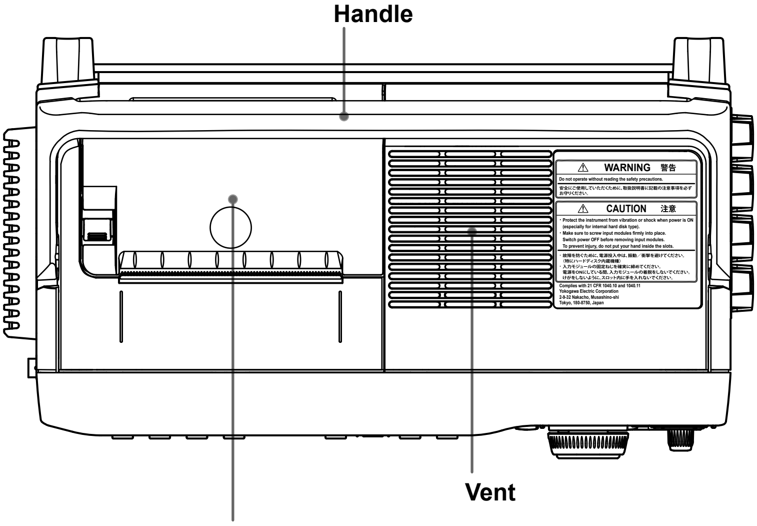
1.1 Top Panel, Front Panel, Right Side Panel, and Left Side Panel

Top Panel


Handle
WARNING 警告
CAUTION 注意
Vent

Built-in printer (optional)
You can print the display.

Front Panel

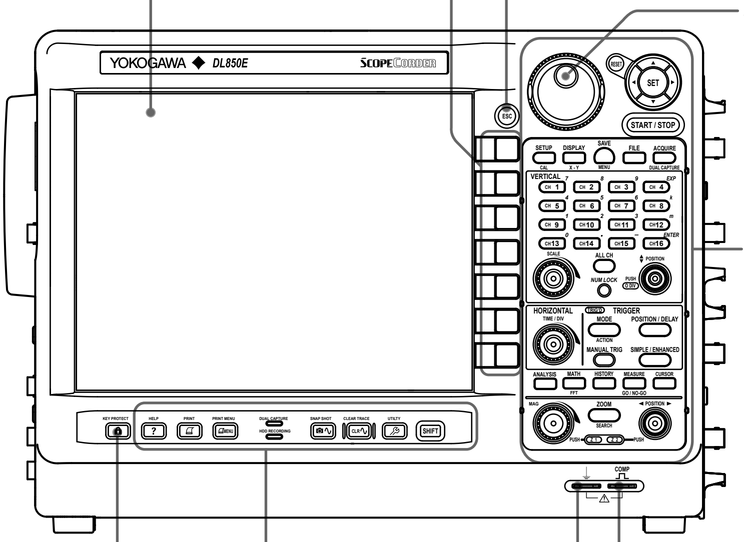
Soft keys
Use to select items on the setup menus that appear during configuration.

LCD
Description of the displayed contents → Section 1.3

ESC key
Use to clear setup menus and pop-up menus.

Jog shuttle
Use to change values and move cursors. Turn the shuttle ring to vary the rate at which values change. The rate is based on the shuttle ring angle.

Setup and execution keys and knobs
Explanation → Section 1.2


YOKOGAWA ◆ DL850E
SCOPECORDER
ESC
RESET
SET
START / STOP
SETUP
DISPLAY
SAVE
FILE
ACQUIRE
CAL
X - Y
MENU
DUAL CAPTURE
VERTICAL
CH 1
CH 2
CH 3
CH 4
CH 5
CH 6
CH 7
CH 8
CH 9
CH 10
CH 11
CH 12
CH13
CH14
CH15
CH16
ENTER
SCALE
ALL CH
POSITION
NUM LOCK
PUSH
HORIZONTAL
TRIGGER
TIME / DIV
MODE
POSITION / DELAY
ACTION
MANUAL TRIG
SIMPLE / ENHANCED
ANALYSIS
MATH
HISTORY
MEASURE
CURSOR
FFT
GO / NO-GO
MAG
ZOOM
SEARCH
KEY PROTECT
HELP
PRINT
PRINT MENU
DUAL CAPTURE
HDD RECORDING
SNAP SHOT
CLEAR TRACE
UTILITY
SHIFT
COMP

Setup and execution keys
Explanation → Section 1.2

KEY PROTECT key
Locks the keys. → Section 1.2

Probe compensation signal output terminal (1 kHz/1 Vp-p) ⚠
Transmits correction signals for probes.
Probe correction procedure → Section 3.6

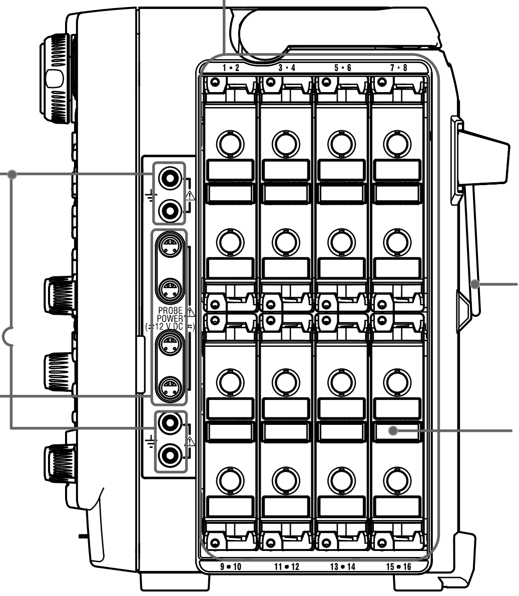
Functional ground terminal ⚠
Connect a ground wire to this terminal when performing probe correction.

Right Side Panel

Input module installation slot
There are a total of eight slots.
Input module insertion and removal method → Section 3.3

Input channel arrangement

Slot	1	2	3	4
	○ CH1	○ CH3	○ CH5	○ CH7
	○ CH2	○ CH4	○ CH6	○ CH8
	○ CH9	○ CH11	○ CH13	○ CH15
	○ CH10	○ CH12	○ CH14	○ CH16
Slot	5	6	7	8



Functional ground terminal ⚠
Use to connect the ground wire of a high-voltage differential probe or enhance the grounding of the measurement equipment.
Probe connection method → Section 3.5

Probe power supply terminal (optional) ⚠
Use to supply power (±12 V) to current probes.
Probe connection method → Section 3.5

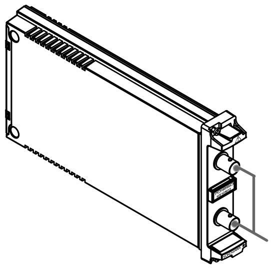
Stand
Setup method → Section 3.2

Empty-slot protection cover
Attach to slots that do not have input modules installed.

Input Modules

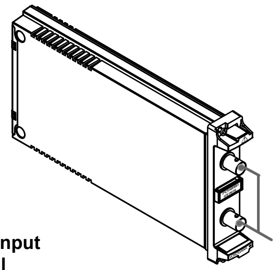
The following 17 input modules are available.

High-Speed 10 MS/s, 12-Bit Isolation Module
HS10M12 (model: 701250)



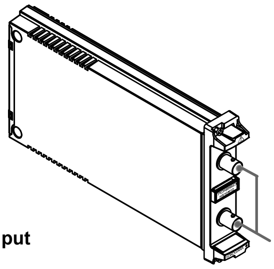
Signal input terminal (2ch)

High-Speed High-Resolution 1 MS/s, 16-Bit Isolation Module
HS1M16 (model: 701251)



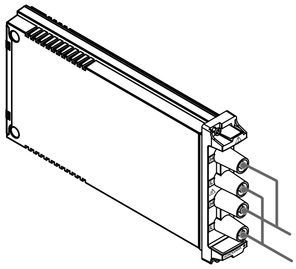
Signal input terminal (2ch)

High-Speed 10 MS/s, 12-Bit Non-Isolation Module
NONISO_10M12 (model: 701255)



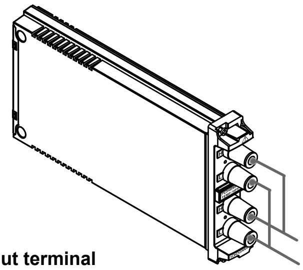
Signal input terminal (2ch)

High-Voltage 100 kS/s, 16-Bit Isolation Module (with RMS)
HV (with RMS) (model: 701267)



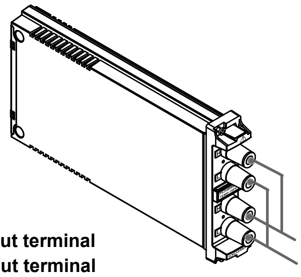
H input terminal
L input terminal
(2ch)

Universal (Voltage/Temp.) Module
UNIVERSAL (model: 701261)



H input terminal
L input terminal
(2ch)

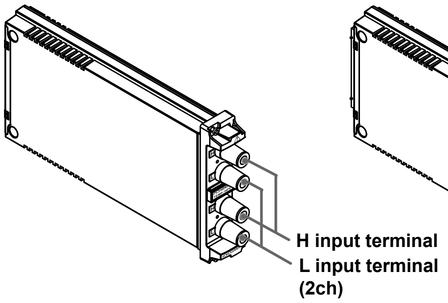
Universal (Voltage/Temp.) Module (with AAF)
UNIVERSAL (AAF) (model: 701262)



H input terminal
L input terminal
(2ch)

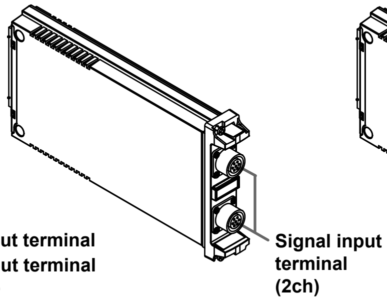
Temperature, High Precision Voltage Isolation Module

TEMP/HPV (model: 701265)


H input terminal
L input terminal
(2ch)

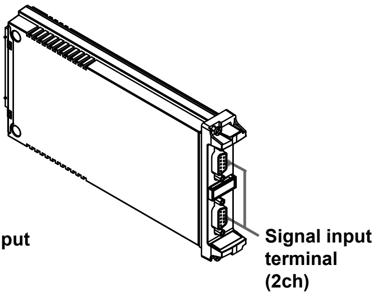
Strain Module (NDIS)

STRAIN_NDIS (model: 701270)


Signal input
terminal
(2ch)

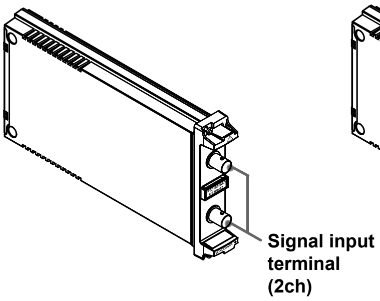
Strain Module (DSUB, Shunt-Cal)

STRAIN_DSUB (model: 701271)


Signal input
terminal
(2ch)

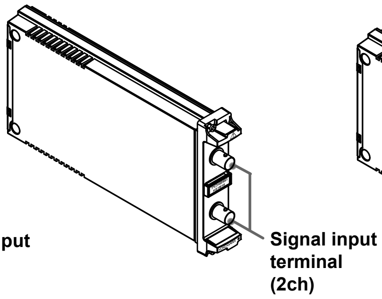
Acceleration/Voltage Module (with AAF)

ACCL/VOLT (model: 701275)


Signal input
terminal
(2ch)

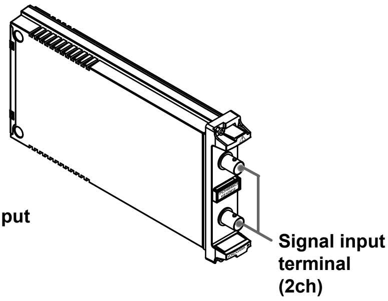
Frequency Module

FREQ (model: 701280)


Signal input
terminal
(2ch)

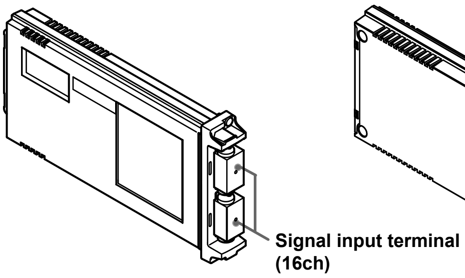
High-Speed 100 MS/s, 12-Bit Isolation Module

HS100M12 (model: 720210)


Signal input
terminal
(2ch)

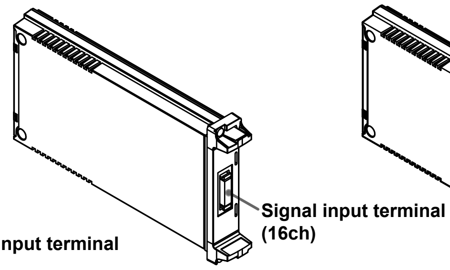
16-CH Voltage Input Module

16CH VOLT (model: 720220)


Signal input terminal
(16ch)

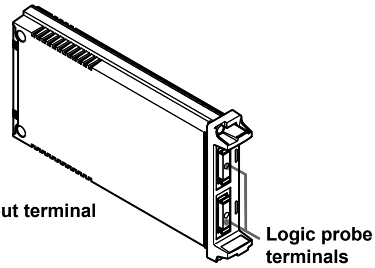
16-CH Temperature/Voltage Input Module

16CH TEMP/VOLT (model: 720221)


Signal input terminal
(16ch)

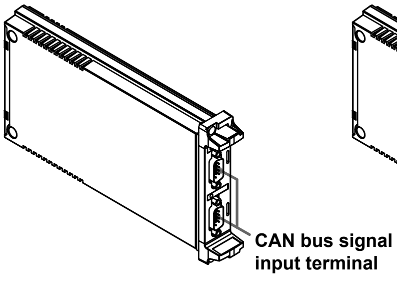
Logic Input Module

LOGIC (model: 720230)


Logic probe
terminals

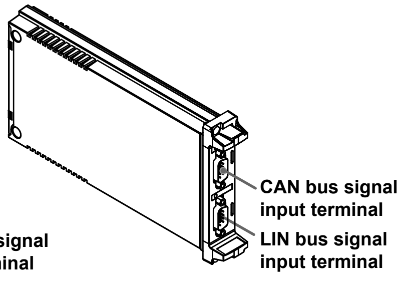
CAN Bus Monitor Module

CAN MONITOR (model: 720240)

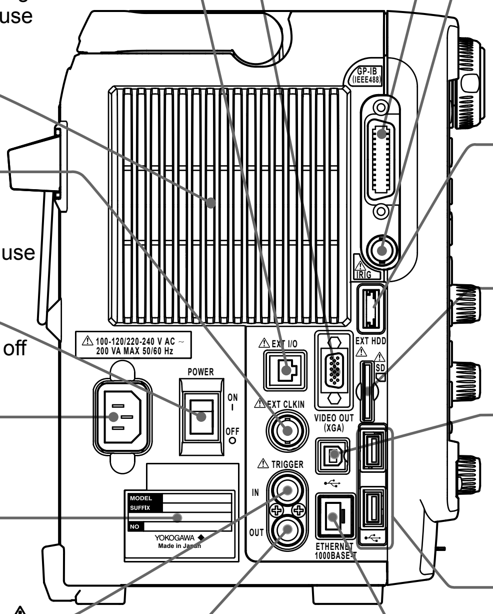

CAN bus signal
input terminal

CAN & LIN Bus Monitor Module

CAN & LIN (model: 720241)


CAN bus signal
input terminal
LIN bus signal
input terminal

Left Side Panel



Video signal output terminal
You can output the displayed image in an XGA RGB signal.
Explanation about how to use → Section 5.4

GO/NO-GO and external start/stop I/O connector ⚠
Transmits GO/NO-GO determination I/O signals.
Can also be used to start and stop the DL850E/DL850EV through external control.
Explanation about how to use → Section 5.5

Vent

External-clock input terminal ⚠
Use when applying an external clock signal.
Explanation about how to use → Section 5.3

Main power switch
Turning the power on and off → Section 3.4

Power inlet ⚠
Power connection → Section 3.4

Name plate

Trigger input terminal ⚠
Use when applying an external trigger signal.
Explanation about how to use → Section 5.1

Trigger output terminal ⚠
Use to transmit trigger signals.
Explanation about how to use → Section 5.2

GP-IB connector (optional)
Use to communicate with the DL850E /DL850EV through the GP-IB interface. For information about the DL's communication features, see the communications interface user's manual.

IRIG input terminal (option) ⚠
Use this terminal to apply external sync signals.
Explanation about how to use → Section 5.6 (/C20)

External HDD connector (optional) ⚠
Use to connect an external hard disk.
Explanation about how to use → User's manual

SD memory card slot ⚠
Use to connect an SD memory card.
Explanation about how to use → User's manual

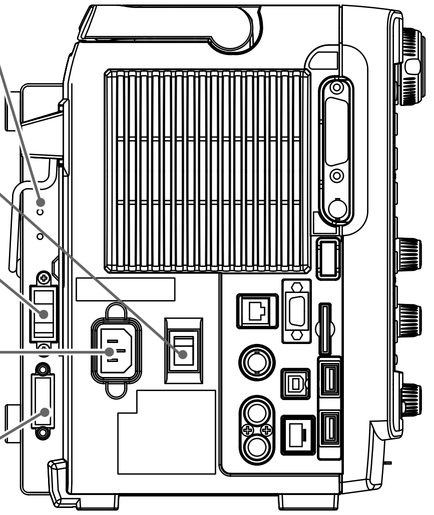
USB port for PCs
Use to connect the DL850E/DL850EV to a PC that has a USB port.
Explanation about how to use → Communication interface user's manual

USB ports for peripherals
Use to connect a USB keyboard, mouse, or storage device.
Explanation about how to use → Section 4.3 and User's manual

Ethernet port (1000BASE-T/100BASE-TX)
Use to connect the DL850E/DL850EV to a LAN. Explanation about how to use → Feature's guide and communication interface user's manual

DC Power Supply Model (DL850EV)

Only the parts that are different from the standard model are shown below.



Power supply status LED
Displays the status of the AC power supply or DC power supply.
The status indicator → Section 3.4

Power switch (AC)
Turning the power on and off → Section 3.4

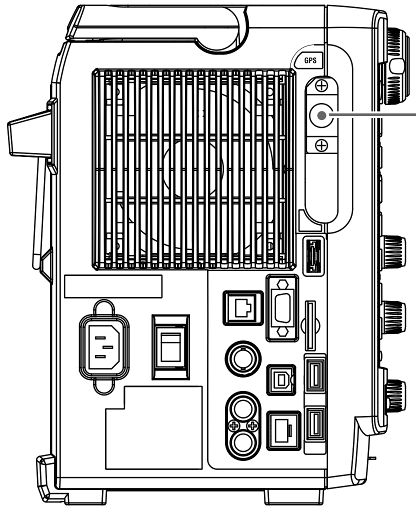
Power switch (DC)
Turning the power on and off → Section 3.4

AC power connector ⚠
Power connection → Section 3.4

DC power connector ⚠
Power connection → Section 3.4

GPS Interface Model

Only the parts that are different from the standard model are shown below.



GPS input terminal (option)

Use this terminal to apply external sync signals.

Explanation about how to use
→ Section 3.19 (/C30)

1.2 Panel Keys and Knobs

Vertical Axis

CH1 to CH16 Keys

These keys display menus for turning the display of each channel on and off and configuring settings such as display label settings, input coupling settings, the probe attenuation or the current-to-voltage conversion ratio, the bandwidth limit, the vertical position, vertical zoom settings, the offset value, and linear scaling. Also, you can press a key to select the channel that the SCALE knob will control. Channel keys illuminate when their corresponding channel is on.
After you press NUM LOCK (see below), you can press a channel key to enter the number displayed to the upper right of the key in white.

ALL CH Key

Press this key to display a window in which you can configure all the settings from the menus that appear when you press CH1 to CH16. The settings appear in a list.

NUM LOCK Key

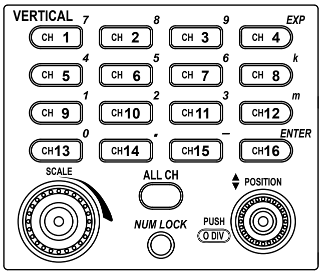
Press this key to use the CH1 to CH16 keys to enter numbers.

SCALE Knob

Use this knob to set the vertical scale. Before you turn this knob, select the target waveform by pressing a key from CH1 to CH16. If you change the scale while waveform acquisition is stopped, the setting actually takes effect when you restart waveform acquisition.

⬍POSITION Knob (Vertical POSITION Knob)

Use this knob to adjust the vertical display position (vertical position) of an input waveform. Before you turn this knob, select the target waveform by pressing a key from CH1 to CH16. This knob has a push switch. You can press the knob to reset the position to 0.00 div.



Horizontal Axis

TIME/DIV knob

Use this knob to set the time-axis scale. If you change the scale while waveform acquisition is stopped, the scale change actually takes effect when you restart waveform acquisition.

HORIZONTAL
TIME / DIV

TRIGGER Group Keys

(SHIFT+) MODE Key

Displays a menu for selecting the trigger mode. Press SHIFT and then MODE to display a menu for configuring action-on settings.

POSITION/DELAY Key

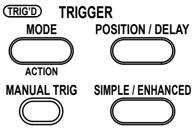
Press this key to set the trigger position and the trigger delay.

MANUAL TRIG Key

Press this key to make the DL850E/DL850EV trigger regardless of the trigger settings.

SIMPLE/ENHANCED Key

Displays a trigger setup menu.



Other Keys

ANALYSIS Key

Displays a menu for performing power math. This key is valid on models with the /G5 option.

(SHIFT+) MATH Key

Displays a menu for waveform computation. Press SHIFT and then MATH to display a menu for configuring FFT computation.

HISTORY Key

Displays a menu for using the history feature to recall data.

(SHIFT+) MEASURE Key

Displays a menu for automated measurement of waveform parameters. Press SHIFT and then MEASURE to display a menu for GO/NO-GO determination.

CURSOR Key

Displays a menu used when performing cursor measurements.

(SHIFT+) ZOOM Key

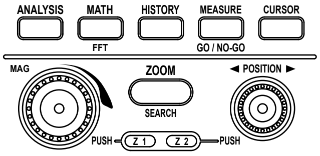
Displays a waveform zoom display menu. Press SHIFT and then ZOOM to display a menu for data searching (the search & zoom function).

MAG Knob

Use this knob to set the zoom factors for the Zoom1 and Zoom2 zoom boxes. This knob has a push switch. Press the MAG knob to switch the zoom box whose zoom factor is set by it.

◄POSITION► Knob (Zoom POSITION knob)

Use this knob to set the zoom position. This knob has a push switch. Press the POSITION knob to switch the zoom box whose zoom position is set by it.



RESET Key

Resets the value to its default value.

SET Key

Press this key to select the menu item that you have moved the cursor to using the jog shuttle. You can also press the SET key to start entering a value or characters.

Arrow Keys (▲▼►◄ keys)

Use the ►◄ keys to move the cursor between numeric digits. Use the ▲▼ keys to increment or decrement the value of a digit. You can also use the ▲▼ keys to select setup items.

START/STOP Key

Starts and stops waveform acquisition according to the trigger mode. The key is illuminated while the DL850E/DL850EV is acquiring waveforms.

(SHIFT+) SETUP Key

Displays a menu for initializing the settings to their factory defaults; performing auto setup, which automatically sets the DL850E/DL850EV according to the input signal; storing and recalling setup information; and so on. Press SHIFT and then SETUP to display a calibration menu.

(SHIFT+) DISPLAY Key

Use this key to configure the display. Press SHIFT and then DISPLAY to display an X-Y display menu.

(SHIFT+) SAVE Key

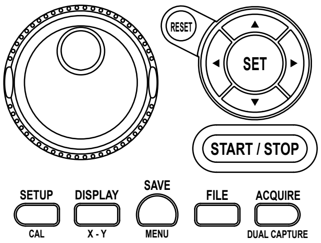
Press this key to save waveform or screen capture data to a storage medium. Press SHIFT and then SAVE to display a menu for configuring the save operation.

FILE Key

Press this key to save or load data from a storage medium or to display a menu for file manipulation.

(SHIFT+) ACQUIRE Key

Displays a menu used to set the waveform acquisition mode. Press SHIFT and then ACQUIRE to display a menu for configuring the dual capture feature.



KEY PROTECT Key

When you press this key, it illuminates, and the keys on the front panel are locked. Press the key again to unlock the keys.

HELP Key

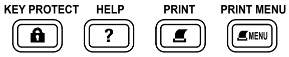
Turns on and off the help window, which explains various features.

PRINT Key

Use this key to save and print screen capture data.

PRINT MENU Key

Displays a menu for printing screen captures to the built-in printer or a network printer or displays a menu for saving screen capture data to a storage medium.



SNAPSHOT Key

Retains the currently displayed waveforms on the screen in white. Snapshot waveforms can be saved and loaded.

CLEAR TRACE Key

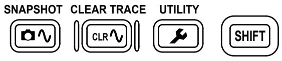
Clears the waveform acquired using the snapshot function and accumulated waveforms.

UTILITY Key

Displays a menu for configuring system, communication, network, and environment settings; for performing self tests; and for displaying system information (information about installed modules, installed options, and the firmware version).

SHIFT Key

Press this key once to access the features that are written in purple below each key. The shift key illuminates when the keys are shifted. Pressing the key again clears the shifted condition.



Note

Press SHIFT and then CLEAR TRACE to switch from remote mode to local mode. For details, see the communication interface user’s manual.

Notes about Using of Knobs

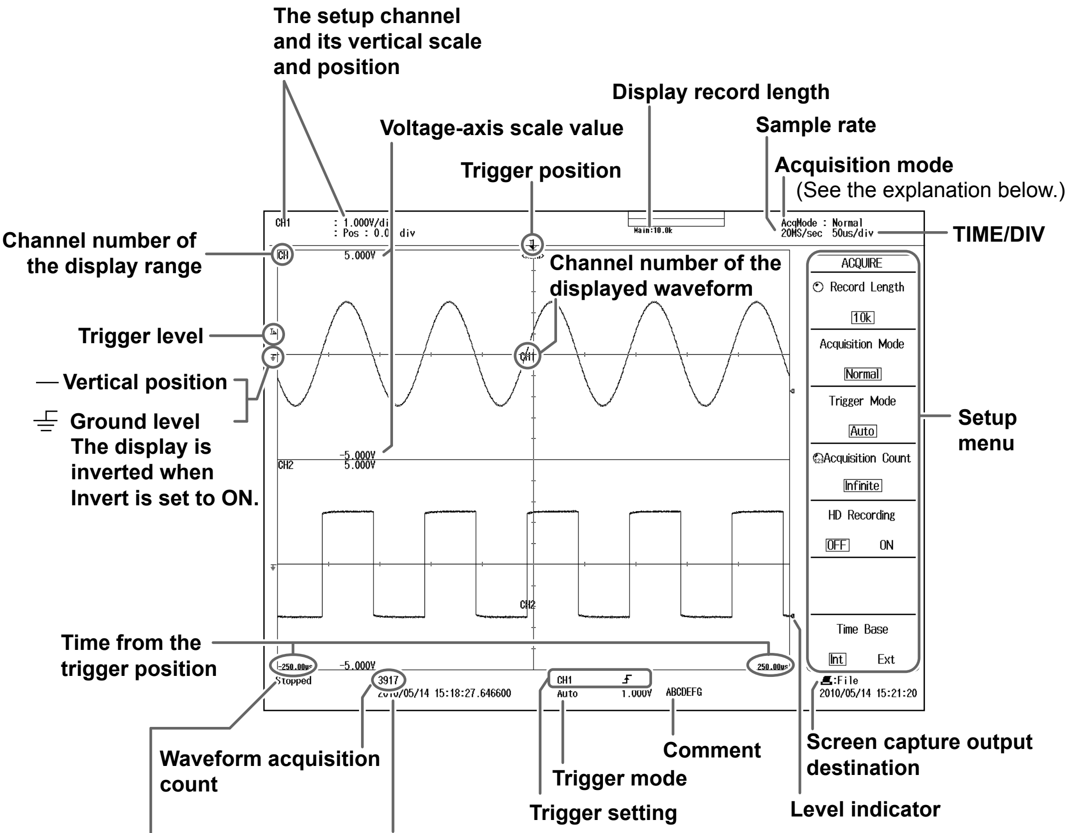
The vertical POSITION, ZOOM MAG, and ZOOM POSITION knobs have push switches. Push the knobs straight. If you push a knob at an angle, it may not operate properly. If this happens, push the knob straight one more time.

CAUTION

Do not push the knob sideways with strong force. Doing so may break the knobs.

1.3 Screens

Normal Waveform Display


The setup channel and its vertical scale and position
Display record length
Voltage-axis scale value
Sample rate
Trigger position
Acquisition mode
(See the explanation below.)
Channel number of the display range
TIME/DIV
Channel number of the displayed waveform
Trigger level
Vertical position
Ground level
The display is inverted when Invert is set to ON.
Setup menu
Time from the trigger position
Waveform acquisition count
Comment
Screen capture output destination
Trigger mode
Trigger setting
Level indicator
CH1 : 1.000V/div
: Pos : 0.0 div
Main:10.0k
AcqMode : Normal
20MS/sec 50us/div
5.000V
-5.000V
CH2
ACQUIRE
Record Length
10k
Acquisition Mode
Normal
Trigger Mode
Auto
Acquisition Count
Infinite
HD Recording
OFF ON
Time Base
Int Ext
-250.00us
250.00us
Stopped
3917
2010/05/14 15:18:27.646600
CH1
Auto
1.000V
ABCDEFG
:File
2010/05/14 15:21:20

Time of the waveform time reference

When Trigger Mode is set to OnStart, the reference is the measurement start time.
When Trigger Mode is set to Auto and the roll display is in use, the reference is the measurement stop time.
In other situations, the reference is the trigger time.

Waveform acquisition condition

Stopped
Running
Waiting for trigger

Pre...	:Acquiring pre data
Post...	:Acquiring post data
HD out	:Continuous writing to hard disk

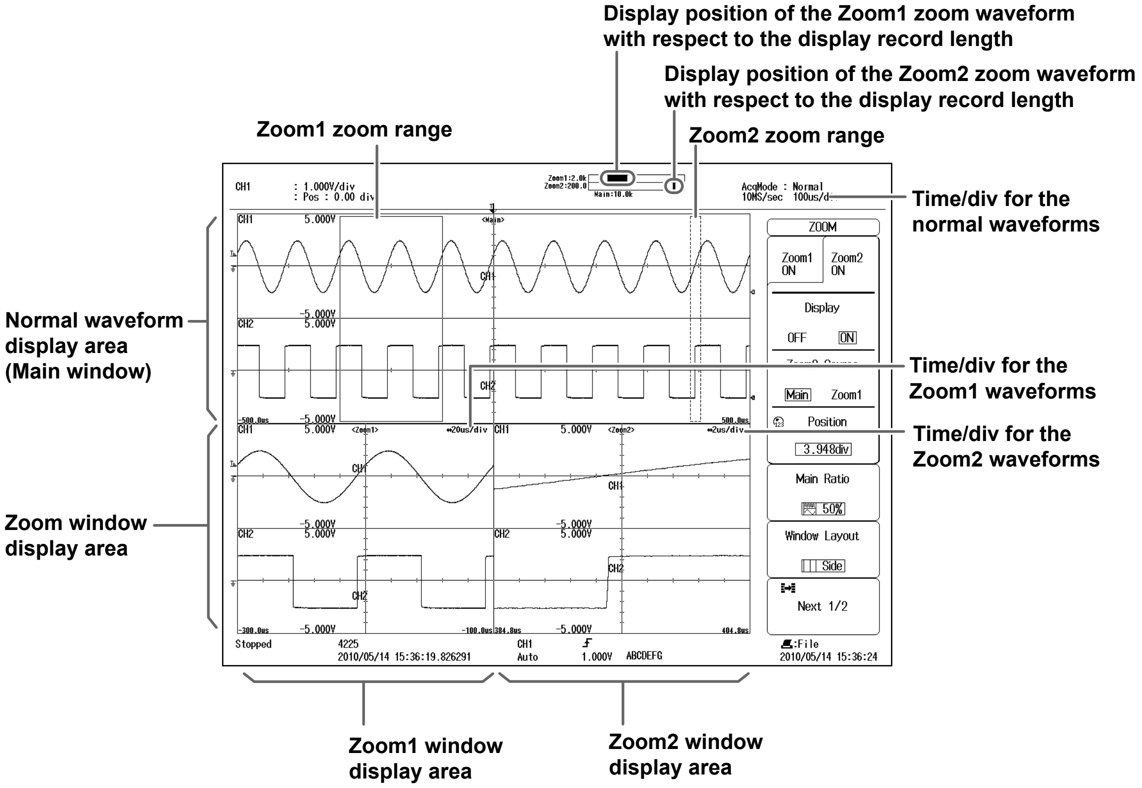
Acquisition Mode Indication

Normal : Normal mode
Env : Envelope mode
Avg : Average mode
BoxAvg : Box average mode

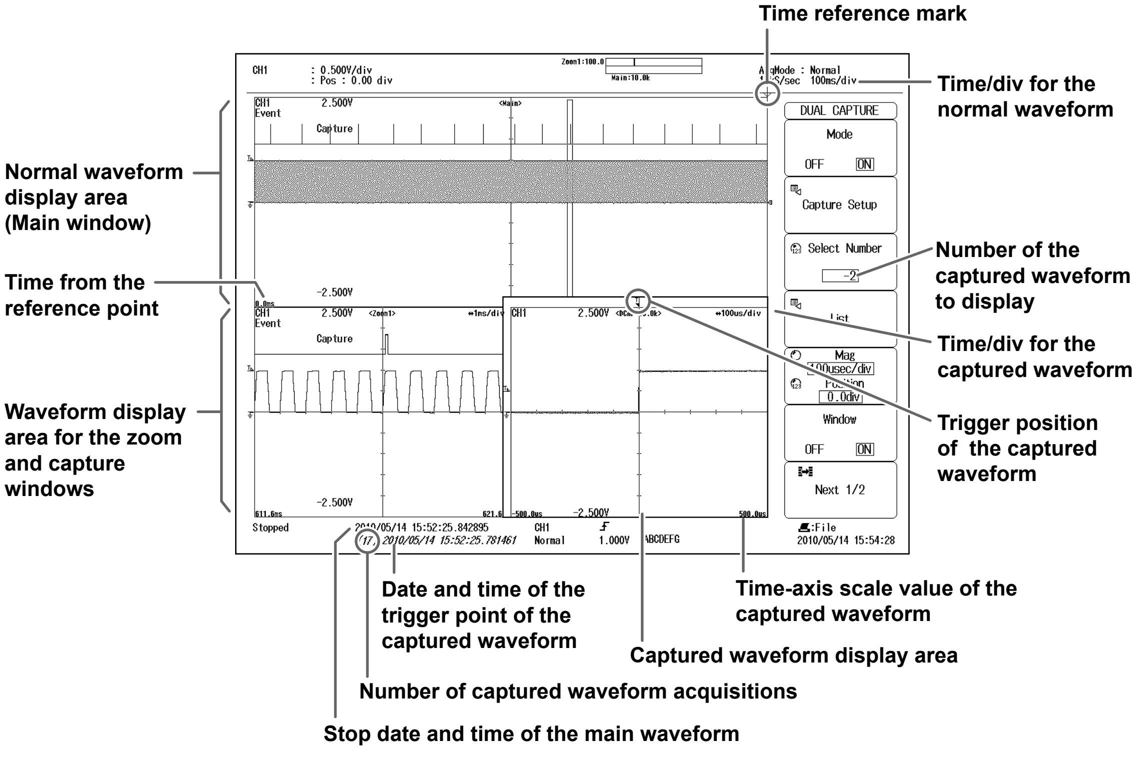
Note

The DL850E/DL850EV LCD may include a few defective pixels. For details, see section 6.4, “Display.”

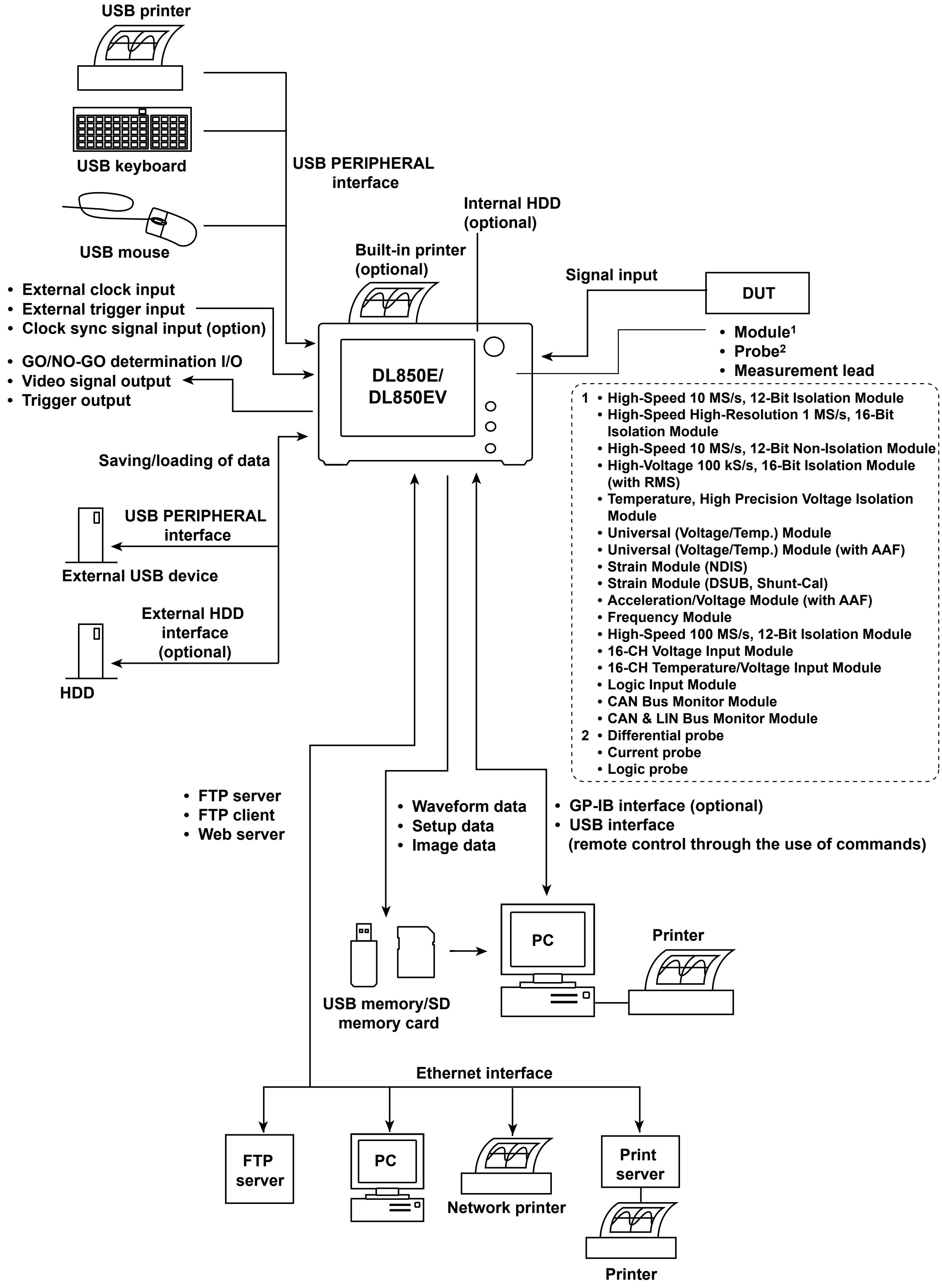
Zoom Waveform Display


Display position of the Zoom1 zoom waveform with respect to the display record length
Display position of the Zoom2 zoom waveform with respect to the display record length
Zoom1 zoom range
Zoom2 zoom range
Time/div for the normal waveforms
Normal waveform display area (Main window)
Time/div for the Zoom1 waveforms
Time/div for the Zoom2 waveforms
Zoom window display area
Zoom1 window display area
Zoom2 window display area
ZOOM
Zoom1 ON
Zoom2 ON
Display
OFF ON
Main Zoom1
Position
3.948div
Main Ratio
50%
Window Layout
Side
Next 1/2
Stopped
2010/05/14 15:36:19.826291
2010/05/14 15:36:24

Dual Capture Display


Time reference mark
Time/div for the normal waveform
Normal waveform display area (Main window)
Time from the reference point
Number of the captured waveform to display
Time/div for the captured waveform
Trigger position of the captured waveform
Waveform display area for the zoom and capture windows
Date and time of the trigger point of the captured waveform
Time-axis scale value of the captured waveform
Captured waveform display area
Number of captured waveform acquisitions
Stop date and time of the main waveform
DUAL CAPTURE
Mode
OFF ON
Capture Setup
Select Number
-2
List
Window
OFF ON
Next 1/2
Stopped
2010/05/14 15:52:25.842895
17
2010/05/14 15:52:25.781461
2010/05/14 15:54:28

1.4 System Configuration


USB printer
USB keyboard
USB mouse
USB PERIPHERAL interface
Internal HDD (optional)
Built-in printer (optional)
Signal input
DUT
• External clock input
• External trigger input
• Clock sync signal input (option)
• GO/NO-GO determination I/O
• Video signal output
• Trigger output
DL850E/ DL850EV
• Module¹
• Probe²
• Measurement lead
1 • High-Speed 10 MS/s, 12-Bit Isolation Module
• High-Speed High-Resolution 1 MS/s, 16-Bit Isolation Module
• High-Speed 10 MS/s, 12-Bit Non-Isolation Module
• High-Voltage 100 kS/s, 16-Bit Isolation Module (with RMS)
• Temperature, High Precision Voltage Isolation Module
• Universal (Voltage/Temp.) Module
• Universal (Voltage/Temp.) Module (with AAF)
• Strain Module (NDIS)
• Strain Module (DSUB, Shunt-Cal)
• Acceleration/Voltage Module (with AAF)
• Frequency Module
• High-Speed 100 MS/s, 12-Bit Isolation Module
• 16-CH Voltage Input Module
• 16-CH Temperature/Voltage Input Module
• Logic Input Module
• CAN Bus Monitor Module
• CAN & LIN Bus Monitor Module
2 • Differential probe
• Current probe
• Logic probe
Saving/loading of data
USB PERIPHERAL interface
External USB device
External HDD interface (optional)
HDD
• FTP server
• FTP client
• Web server
• Waveform data
• Setup data
• Image data
• GP-IB interface (optional)
• USB interface (remote control through the use of commands)
PC
Printer
USB memory/SD memory card
Ethernet interface
FTP server
PC
Network printer
Print server
Printer

2.1 Vertical and Horizontal Axes

Vertical Axis

This section explains how to configure the signal input settings and the amplitude-direction display settings. The items that can be set vary depending on the installed modules. The channel menu that corresponds to the key you pressed (CH1 to CH16) appears. You can set the various vertical axis settings for each channel. Press ALL CH to display a screen in which you can configure the settings of all channels while viewing the settings in a list.

DL850E/DL850EV Measurement Items

When the DL850E/DL850EV is equipped with the modules listed below, it can measure voltage, temperature, strain, acceleration, frequency, logic, CAN bus signals, LIN bus signals, and so on.

Voltage

701250 (HS10M12), 701251 (HS1M16), 701255 (NONISO_10M12), 701267 (HV (with RMS)), 720210 (HS100M12), 701261 (UNIVERSAL), 701262 (UNIVERSAL (AAF)), 701265 (TEMP/HPV), 701275 (ACCL/VOLT)

Voltage (For the 16-CH Voltage Input Module)

720220 (16CH VOLT)

Temperature

701261 (UNIVERSAL), 701262 (UNIVERSAL (AAF)), 701265 (TEMP/HPV)

Temperature (For the 16-CH Temperature/Voltage Input Module)

720221 (16CH TEMP/VOLT)

Strain

701270 (STRAIN_NDIS), 701271 (STRAIN_DSUB)

Acceleration

701275 (ACCL/VOLT)

Frequency

701280 (FREQ)

Logic

720230 (LOGIC)

CAN Bus Signal Monitoring

720240(CAN MONITOR), 720241(CAN & LIN)

This module can only be used with the DL850EV.

LIN Bus Signal Monitoring

720241(CAN & LIN)

This module can only be used with the DL850EV.

Vertical Scale

The vertical scale is used to adjust the displayed waveform amplitude so that you can easily view signals. You can set the vertical scale to determine the value per grid square (1 div) displayed on the screen and to set the measurement range.

Use the SCALE knob to set the vertical scale for each channel.

Vertical Position

Because the DL850E/DL850EV can display many waveforms, the waveforms may overlap and be difficult to view. If this happens, you can adjust the vertical display position to make waveforms easier to view (vertical position).

Use the POSITION knob to set the vertical position for each channel.

Input Coupling

You can change the input coupling setting to match the signal that you are measuring. By changing the setting, you can choose how the vertical-axis (voltage-axis) control circuit is coupled to the input signal. The following types of input coupling are available: DC, AC, GND, TC, DC-RMS, AC-RMS, ACCEL, and OFF.* Set the appropriate input coupling for each input module.

* You can only select OFF for sub channels on the 16-CH voltage input module or the 16-CH temperature/voltage input module. Sub channels set to OFF are not measured.

Vertical Zoom

You can zoom the waveform vertically. You can zoom the waveform by setting the vertical magnification or by setting upper and lower display limits.

Linear Scaling

Linear scaling is a function that converts measured values into physical values and reads them directly. There two types of linear scaling:

AX + B

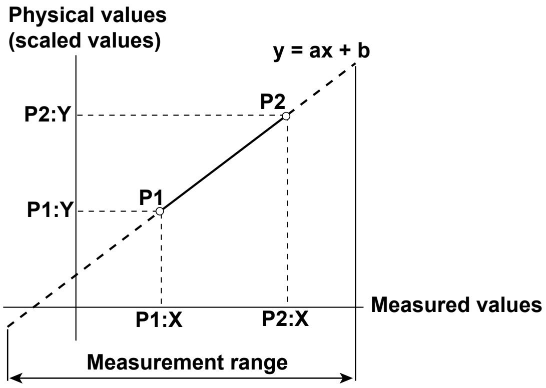
Using scaling coefficient A and offset B, the DL850E/DL850EV scales values according to the equation below.

Y= AX + B (where X is the measured value and Y is the physical value)

P1-P2

The DL850E/DL850EV determines the scale conversion equation (y = ax + b) using four values that you specify: two measured values (P1:X, P2:X) and the value that each one should be converted to (P1:Y, P2:Y).

The DL850E/DL850EV scales values using the scale conversion equation that it determines.



Horizontal Axis (Time Axis)

Time Axis Setting

Normally, under the initial settings, the time axis scale is set as a length of time per grid division (1 div). The selectable range is 100 ns/div to 3 days/div. As you adjust the value, the unit changes between seconds, minutes, hours, and days automatically. Because the horizontal display range is 10 div, the amount of time on the waveform that is displayed is equal to the time axis setting × 10.

* When the 720210 (HS100M12) module is installed, the scale range starts at 100 ns/div; when it is not installed, the scale range starts at 1 μs/div.

Internal and External Clocks (Time base selection)

Under the initial settings, the DL850E/DL850EV samples the measured signal using the internal clock signal produced by its internal time-base circuit.

You can also use an external clock signal to control sampling. Apply the external clock signal to the external clock input terminal. This external clock input is useful for synchronizing to the clock signal of the waveform that is being measured.

Relationship between the Time Axis Setting, Record Length, and Sample Rate

If you change the time axis setting, the sample rate and the acquisition-memory record length also change. For details, see appendix 1.

Sample Rate

If you change the time axis setting, the sample rate also changes. The sample rate is the number of samples-per-second (S/s). When the sample rate is low compared to the frequency of the input signal, the high-frequency components of the waveform are misread as low-frequency components. To prevent the high-frequency components from being misread, sample the signal at the highest sample rate possible, or set the waveform acquisition mode to Envelope.

Roll Mode Display

When the trigger mode is Auto, Auto Level, Single, or On Start and the time axis setting is 100 ms/div or longer, instead of updating waveforms through triggering (update mode), the DL850E/DL850EV displays the waveforms in roll mode. In roll mode, waveforms scroll from right to left as new data is captured and the oldest values are deleted from the screen.

2.2 Triggering

A trigger is a cue used to display the waveform on the screen. A trigger occurs when the specified trigger condition is met, and a waveform is displayed on the screen.

Trigger Modes

The trigger mode determines the conditions for updating the displayed waveforms. There are six trigger modes: Auto, Auto Level, Normal, Single, N Single, and On Start. The trigger mode setting applies to all trigger types.

Trigger Types

Triggers can be broadly divided into “simple triggers” and “enhanced triggers.”

Simple Triggers

Input Signal Trigger

The DL850E/DL850EV triggers when the trigger source passes through the specified trigger level in the specified way (rising edge, falling edge, or rising or falling edge).

Time Trigger

The DL850E/DL850EV triggers at the specified date and time and at specified intervals afterwards.

External Signal Trigger

The DL850E/DL850EV triggers when the signal applied to the TRIG IN terminal passes through the specified trigger level in the specified way (rising or falling edge).

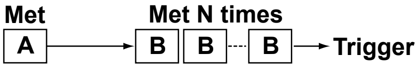
Power Line Signal Trigger

The DL850E/DL850EV triggers on the rising edge of the power supply signal that it is receiving. This trigger enables you to observe waveforms in synchronization with the power supply frequency.

Enhanced Triggers

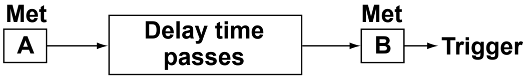
A -> B(N) Trigger

After state condition A is met, the DL850E/DL850EV triggers when state condition B is met N times.



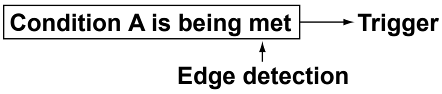
A Delay B Trigger

After state condition A is met and the specified amount of time elapses, the DL850E/DL850EV triggers when state condition B is first met.



Edge On A Trigger (Enhanced)

While state condition A is met, the DL850E/DL850EV triggers on the OR of multiple trigger source edges.


Condition A is being met
Trigger
Edge detection

OR Trigger

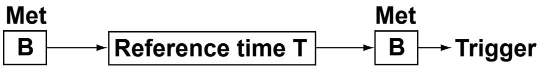
The DL850E/DL850EV triggers on the OR of multiple trigger source edges.

AND Trigger

The DL850E/DL850EV triggers on the AND of multiple trigger source conditions. The DL850E/DL850EV triggers when all the specified conditions are met at a single point.

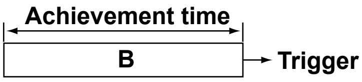
Period Trigger

The DL850E/DL850EV triggers on a specified period of occurrence of state condition B. The DL850E/DL850EV triggers when state condition B occurs again.


Met
B
Reference time T
Met
B
Trigger

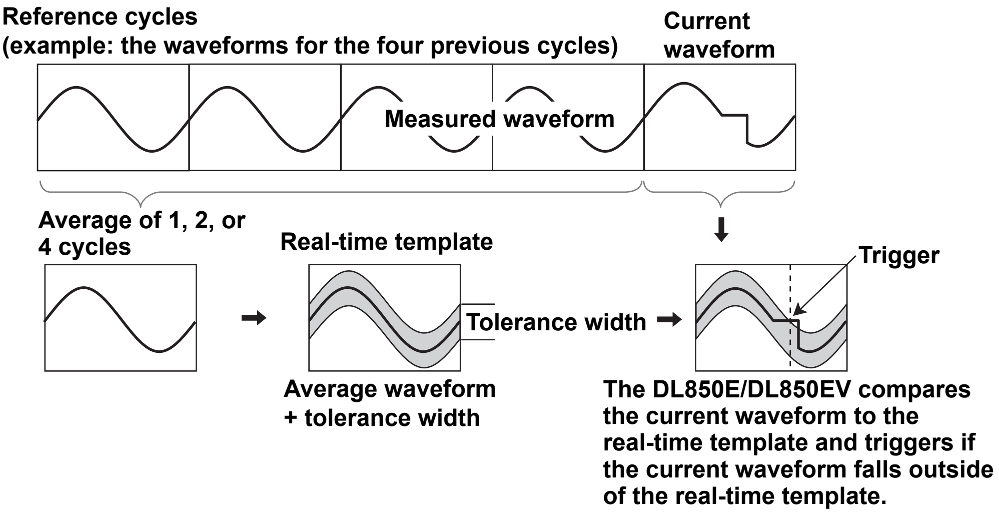
Pulse Width Trigger

The DL850E/DL850EV triggers according to the relationship between the state condition B achievement time and the specified reference times (Time or T1 and T2).


Achievement time
B
Trigger

Wave Window Trigger

The DL850E/DL850EV creates real-time templates (Wave Window) using a number of cycles directly preceding the current waveforms. The DL850E/DL850EV compares the current waveforms to the real-time templates and triggers if one of the current waveforms falls outside of its real-time template.


Reference cycles
(example: the waveforms for the four previous cycles)
Current waveform
Measured waveform
Average of 1, 2, or 4 cycles
Real-time template
Tolerance width
Trigger
Average waveform + tolerance width
The DL850E/DL850EV compares the current waveform to the real-time template and triggers if the current waveform falls outside of the real-time template.

Trigger Source

Trigger source refers to the signal that is used to check the specified trigger conditions. You can set the trigger source to an analog signal, logic signal, realtime math signal, time, external signal, or power line signal. Select the appropriate trigger source for the trigger type.

Trigger Level

Trigger level refers to the signal level used as a reference for detecting a signal’s rising and falling edges or high and low states. With simple triggers such as the edge trigger, the DL850E/DL850EV triggers when the trigger source level passes through the specified trigger level. The range and resolutions that you can use to set the trigger level vary depending on the type of signal being measured.

Trigger Slope

Slope refers to the movement of the signal from a low level to a high level (rising edge) or from a high level to a low level (falling edge). When a slope is used as one of the trigger conditions, it is called a trigger slope.

Trigger Hysteresis

When the trigger source is an analog signal, you can set a width (hysteresis) to the trigger level so that the DL850E/DL850EV does not detect edges when the signal level changes within the specified width. You can set the hysteresis around the trigger level for each type of measured signal.

Trigger Hold-off

The trigger hold-off feature temporarily stops the detection of the next trigger once a trigger has occurred. This feature is useful in cases when you want to change the waveform acquisition interval, such as when you are observing a PCM (pulse code modulation) code or other pulse train signal or when you are using the history feature.

Trigger Position

When you move the trigger position, the ratio of the displayed data before the trigger point (pre-data) to the data after the trigger point (post-data) changes. When the trigger delay is 0 s, the trigger point and trigger positions coincide.

Trigger Delay

The DL850E/DL850EV normally displays waveforms before and after the trigger point. You can set a trigger delay to display waveforms at a specified amount of time after the trigger occurrence.

2.3 Waveform Acquisition

Based on the data that has been stored in the acquisition memory, the DL850E/DL850EV performs various operations, such as displaying waveforms on the screen, computing, measuring cursors, and automatically measuring waveform parameters.
You can set the number of data points to store in the acquisition memory (the record length), enable or disable the sample data averaging feature, and so on.

Record Length

Record length refers to the number of data points that are stored to the acquisition memory for each channel. *Display record length* refers to the data points from the data stored in the acquisition memory that are displayed on the screen. Normally, the acquisition-memory record length and display record length are the same, but the time axis setting may cause them to differ. When you change the time axis setting, the sample rate and record length also change.
On the standard model of the DL850E/DL850EV, you can set the record length to a value between 1 kpoint and 250 Mpoint. Depending on the model, you can set the record length to a value of up to 2 Gpoint.

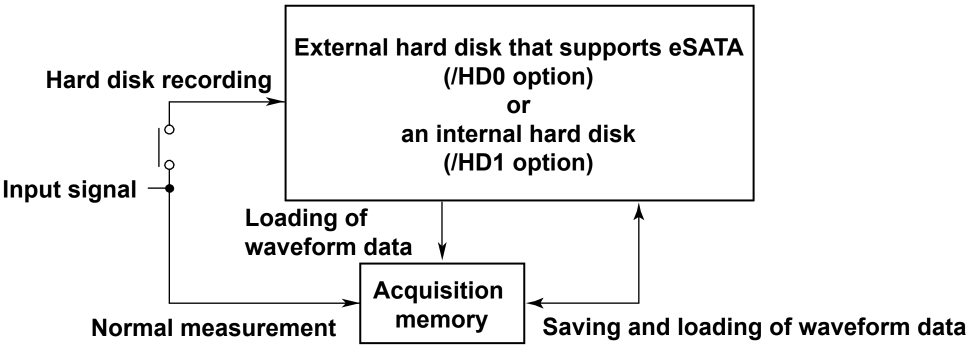
Acquisition Mode

Specify how the DL850E/DL850EV processes the sampled data, stores it in the acquisition memory, and uses it to display waveforms. There are four acquisition modes: Normal, Envelope, Averaging, and BoxAverage.

Hard Disk Recording

When measurement starts, you can record data to an external hard disk that supports eSATA (external Serial ATA; /HD0 option) or to an internal hard disk (/HD1 option).* The recorded data is saved to files automatically. You can load the saved data using the DL850E/DL850EV and convert it to a format that you can analyze on a PC (ASCII or floating point).

* Models with the /HD0 option are equipped with eSATA connectors. You need to purchase a hard disk that supports eSATA separately.


External hard disk that supports eSATA
(/HD0 option)
or
an internal hard disk
(/HD1 option)
Hard disk recording
Input signal
Loading of
waveform data
Acquisition
memory
Normal measurement
Saving and loading of waveform data

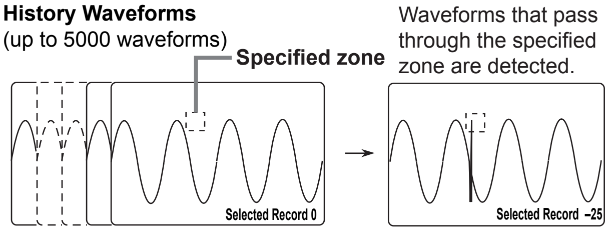
History

When waveforms are being measured, the waveform data stored in the acquisition memory as a result of a trigger occurrence is displayed as a waveform on the DL850E/DL850EV screen and can be viewed. When waveform acquisition is being triggered in succession and an abnormal waveform appears, it is impossible to stop acquisition before a new waveform appears on the screen. Normally, it would be impossible to view the abnormal waveform. However, with the history feature, you can view the past waveform data (history waveforms) stored in the acquisition memory when waveform acquisition is stopped. You can select specific history waveforms and display them.

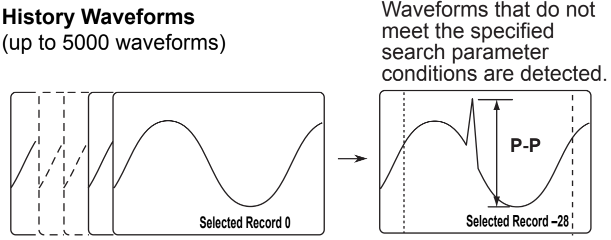
You can also search through the history waveforms for waveforms that meet specified conditions.

- Zone Search
  The DL850E/DL850EV searches for history waveforms that passed (or did not pass) through a specified search zone.
- Waveform Parameter Search
  The DL850E/DL850EV searches for waveforms whose measured waveform parameter values meet (or do not meet) specified conditions.

Zone Search

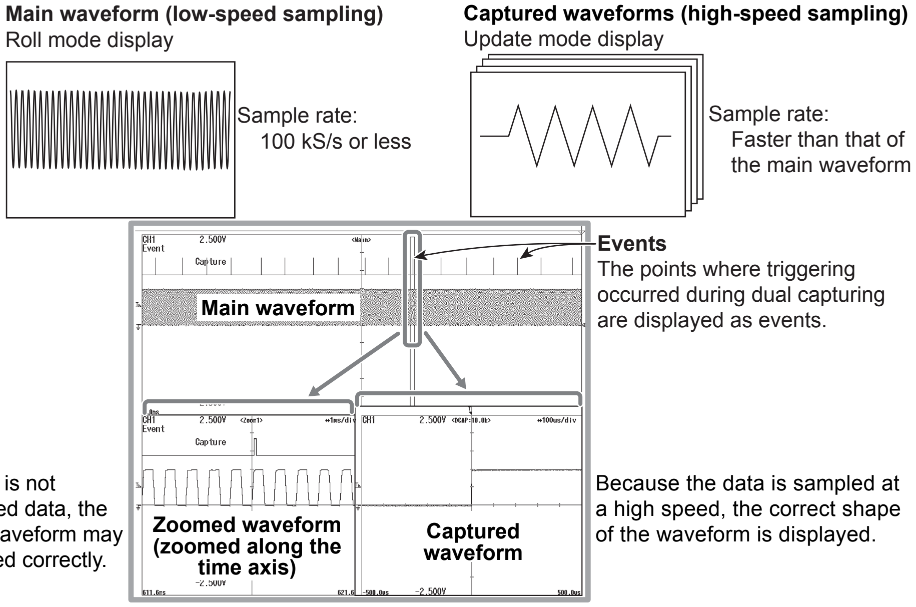

History Waveforms
(up to 5000 waveforms)
Specified zone
Waveforms that pass through the specified zone are detected.
Selected Record 0
Selected Record -25

Waveform parameter search


History Waveforms
(up to 5000 waveforms)
Waveforms that do not meet the specified search parameter conditions are detected.
P-P
Selected Record 0
Selected Record -28

Dual Capturing

You can use dual capturing to simultaneously record a trend at a low sampling speed in roll mode and at a high sampling rate. This is useful for capturing fast phenomenon while observing a trend over a long period of time.


Main waveform (low-speed sampling)
Roll mode display
Sample rate:
100 kS/s or less
Captured waveforms (high-speed sampling)
Update mode display
Sample rate:
Faster than that of the main waveform
CH1
Event
Capture
2.500V
<Main>
Main waveform
<Zoom1>
↔1ms/div
Zoomed waveform (zoomed along the time axis)
-2.500V
611.6ms
<DCAP:10.0k>
↔100us/div
Captured waveform
-500.0us
500.0us
Events

The points where triggering occurred during dual capturing are displayed as events.

Because there is not enough sampled data, the shape of the waveform may not be displayed correctly.

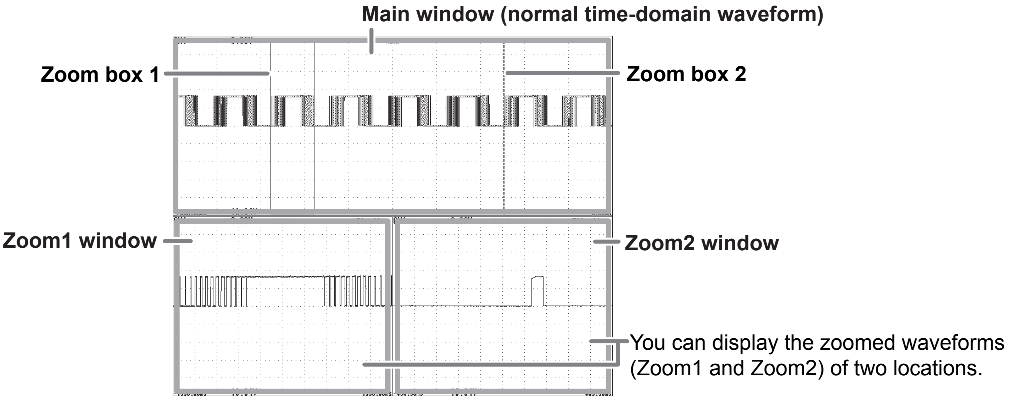
Because the data is sampled at a high speed, the correct shape of the waveform is displayed.

2.4 Waveform Display

The DL850E/DL850EV has a main window for displaying normal time-domain waveforms, zoom windows for displaying zoomed time-axis waveforms, and X-Y windows for displaying X-Y waveforms. In addition, you can split screens and change the sizes of waveform display areas so that waveforms and measured values are easier to see and display an FFT window that shows the results of FFT analysis.

Zooming along the Time Axis (GIGAZoom)

You can magnify displayed waveforms along the time axis. The zoomed waveforms of two locations can be displayed simultaneously (the dual zoom feature). This feature is useful when you set a long acquisition time and want to observe a portion of the waveform closely.



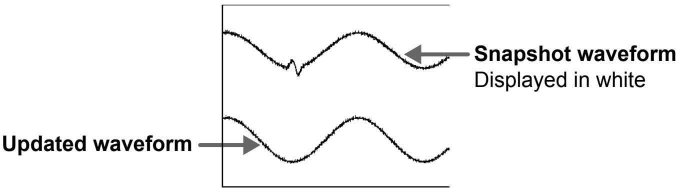
You can display the zoomed waveforms (Zoom1 and Zoom2) of two locations.

Displaying X-Y Waveforms

You can observe the correlation between two waveform signal levels by displaying one signal level on the X-axis (horizontal axis) and a second signal level on the Y-axis (vertical axis). You can display X-Y waveforms at the same time as normal T-Y (time and signal level) waveforms. You can display up to four overlapping X-Y waveforms in both Window1 and Window2. Because multiple X-Y waveforms can be displayed, it is easy to compare the relationships between phases. You can use this feature to evaluate DC motors using Lissajous waveforms.

Snapshot

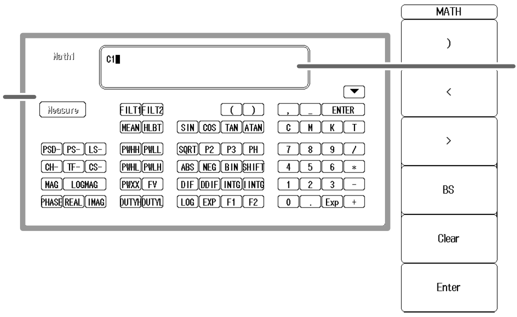
You can continue displaying a waveform on the screen as a snapshot waveform after the screen has been updated and the waveform has been cleared in update mode or after the waveform has left the screen in roll mode. Snapshot waveforms appear in white. You can compare them with new waveforms. You can also save and print snapshot waveforms as screen captures.



2.5 Waveform Computation and Analysis

Waveform Computation

You can perform basic arithmetic, binarization, FFT (power spectrum), and phase shifting (display the waveform with its phase shifted). On models with the /G2 option, you can use a rich variety of functions (square root, trigonometric functions, differentiation, integration, digital filtering, six types of FFT functions, and so on) to define up to eight equations.


Math1
C1
Measure
FILT1 FILT2
MEAN HLBT
( )
SIN COS TAN ATAN
, _ ENTER
C M K T
PSD- PS- LS-
CH- TF- CS-
MAG LOGMAG
PHASE REAL IMAG
PWHH PWLL
PWHL PWLH
PWXX FV
DUTYH DUTYL
SQRT P2 P3 PH
ABS NEG BIN SHIFT
DIF DDIF INTG IINTG
LOG EXP F1 F2
7 8 9 /
4 5 6 *
1 2 3 -
0 . Exp +
MATH
)
<
>
BS
Clear
Enter

Expression configuration dialog box
Use the soft keyboard on the screen to enter an expression.

The expression that you enter appears.

Cursor Measurement

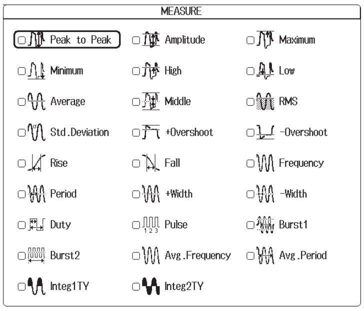
There are cursors for T-Y (time-axis), X-Y, and FFT waveforms. You can position a cursor over a waveform to view the various measured values at the intersection of the cursor and the waveform.

Automated Measurement of Waveform Parameters

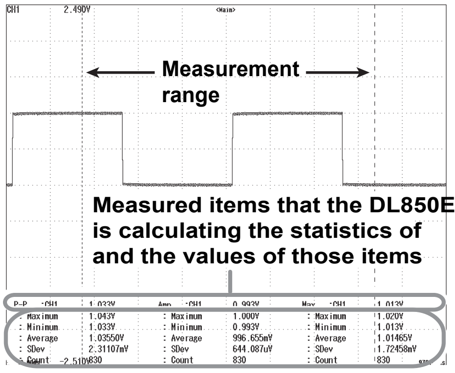
You can use this feature to automatically measure waveform levels, maximum values, frequencies, and other values. For up to 100 Mpoint of waveform data, you can measure 29 waveform parameters (including the delay between channels) that relate to the voltage axis, time axis, and waveform area.

- You can display a total of 32 measured values for all the waveforms.
- You can save a total of 64000 items of data for all the waveforms.
- You can also perform computations on measured waveform parameter values.
- You can display the following statistics for the specified waveform parameter.
  The maximum value (Maximum), minimum value (Minimum), average value (Average), standard deviation (SDev), and number of measured values used to calculate statistics (Count)

Setup Dialog Box


MEASURE
Peak to Peak
Amplitude
Maximum
Minimum
High
Low
Average
Middle
RMS
Std.Deviation
+Overshoot
-Overshoot
Rise
Fall
Frequency
Period
+Width
-Width
Duty
Pulse
Burst1
Burst2
Avg.Frequency
Avg.Period
Integ1TY
Integ2TY

Example of Displayed Statistical Values


CH1
2.490V
<Main>
-2.510V

```
P-P   :CH1      1.033V       Amp   :CH1      0.993V       Max   :CH1      1.013V
 : Maximum      1.043V        : Maximum      1.000V        : Maximum      1.020V
 : Minimum      1.033V        : Minimum      0.993V        : Minimum      1.013V
 : Average      1.03550V      : Average      996.655mV     : Average      1.01465V
 : SDev         2.31107mV     : SDev         644.087uV     : SDev         1.72458mV
 : Count        830           : Count        830           : Count        830
```

Measurement range

Measured items that the DL850E/DL850EV is calculating the statistics of and the values of those items

Maximum: Maximum value
Minimum: Minimum value
Average: Average value
SDev: Standard deviation
Count: Number of measured values used to calculate statistics

There are three statistical processing methods:

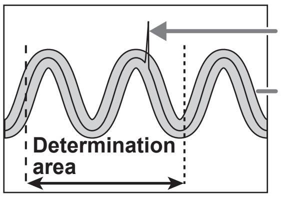
- Normal statistical processing
  While acquiring waveforms, the DL850E/DL850EV measures the measurement items and calculates the statistics of the waveforms that it has acquired so far.
- Cyclic statistical processing (measurement and statistical processing are performed for each period)
  The DL850E/DL850EV divides the waveform into periods starting at the left side of the screen (the oldest waveform) and moving to the right side of the screen, measures the selected measurement items within each period, and performs statistical processing on the measurement items.
- Statistical processing of history waveforms
  The DL850E/DL850EV measures the measurement items and calculates the statistics of history waveforms. Measurement and statistical processing begin with the oldest waveform.

GO/NO-GO Determination

This feature is useful for signal testing on production lines and for tracking down abnormal phenomena. The DL850E/DL850EV determines whether the waveform enters the specified range. When the DL850E/DL850EV returns a GO (or NO-GO) result, specified actions are performed.

Determination Methods

- Waveform Zone
  The DL850E/DL850EV returns GO/NO-GO results based on whether waveforms leave or enter the zone that you create using a base waveform.



The DL850E/DL850EV returns a GO or NO-GO judgment according to the determination condition.

Specified zone

- Waveform Parameter
  Set the upper and lower limits for automated measurement values of waveform parameters. The DL850E/DL850EV performs GO/NO-GO determination based on whether the values are within or outside of the limits.

Actions Performed according to Determination Results

The DL850E/DL850EV can print and save screen captures, save waveform data, beep, and send e-mails according to the results of GO/NO-GO determination.

3.1 Handling Precautions

Safety Precautions

If you are using this instrument for the first time, make sure to thoroughly read the safety precautions given on page ix.

Do Not Remove the Case

Do not remove the case from the instrument. Some sections inside the instrument have high voltages and are extremely dangerous. For internal inspection and adjustment, contact your nearest YOKOGAWA dealer.

Unplug If Abnormal Behavior Occurs

If you notice smoke or unusual odors coming from the instrument, immediately turn off the power and unplug the power cord. If such an irregularity occurs, contact your dealer.

Do Not Damage the Power Cord

Nothing should be placed on the power cord. The cord should be kept away from any heat sources. When unplugging the power cord from the outlet, never pull by the cord itself. Always hold and pull by the plug. If the power cord is damaged, contact your dealer for replacement. Refer to page iv for the part number to use when placing an order.

General Handling Precautions

Do Not Place Objects on Top of the Instrument

Never place other instruments or objects containing water on top of the instrument, otherwise a breakdown may occur.

Do Not Apply Shock or Vibration

Do not apply shock or vibration. Doing so may damage the instrument. Extra caution is needed for the optional internal hard disk, because it is sensitive to vibration and shock. Shocks to the input connectors or probes may turn into electrical noise and enter the instrument via the signal lines.

Do Not Damage the LCD

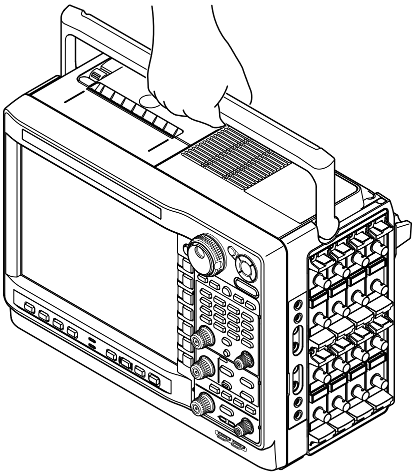
Since the LCD screen is very vulnerable and can be easily scratched, do not allow any sharp objects near it. Also it should not be exposed to vibrations and shocks.

Unplug during Extended Non-Use

Unplug the power cord from the outlet.

When Carrying the Instrument

Remove the power cord and connecting cables. When moving the instrument, use the handle as shown below, or carry it with both hands.



WARNING

- When you hold or put away the handle, be careful not to get your hand caught between the handle and the case.
- When you carry the instrument, be careful not to get your hand caught between the wall, installation surface, or other objects and the instrument.

Cleaning

When cleaning the case or the operation panel, first remove the power cord from the AC outlet. Then, wipe with a dry, soft, clean cloth Do not use chemical such as benzene or thinner. These can cause discoloring and deformation.

3.2 Installing the Instrument

WARNING

- This instrument is designed to be used indoors. Do not install or use it outdoors.
- Install the instrument so that you can immediately remove the power cord if an abnormal or dangerous condition occurs.

CAUTION

If you block the inlet or outlet holes on the instrument, the instrument will become hot and may break down.

Installation Conditions

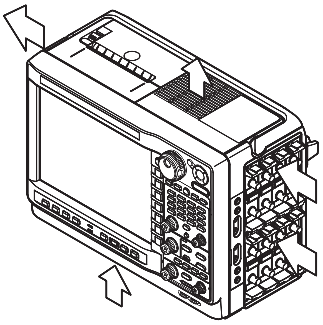
Install the instrument in a place that meets the following conditions.

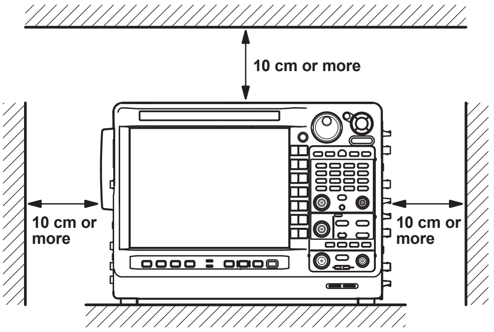
Flat, Even Surface

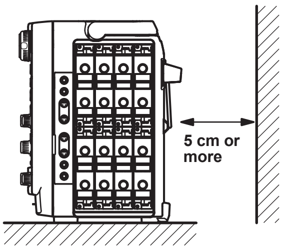
Install the instrument in the correct orientation (see page 3-4) in a safe place, with no tilting from front to back or left to right. When you install the instrument with the rear panel facing down, you can tilt it on its stand. The recording quality of the printer may be hindered when the instrument is placed in an unstable or inclined place.

Well-Ventilated Location

There are inlet holes on the bottom side of the instrument. There are also vent holes for the cooling fan on the left side panel and the top panel. To prevent internal overheating, allow for enough space around the instrument (see the figure below) and do not block the inlet and exhaust holes.







When connecting cables and opening and closing the cover of the built-in printer, provide extra operating space in addition to the space in the figure shown above.

Ambient Temperature and Humidity

Ambient temperature:	5 to 40°C
Ambient humidity:	20 to 80% RH (when the printer is not used; no condensation) 35 to 80% RH (when the printer is used)

Note

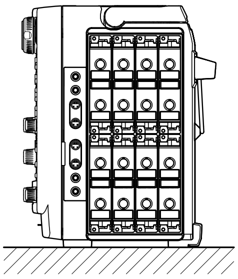
- To ensure high measurement accuracy, operate the instrument in the 23 ±5°C temperature range and 20 to 80% RH.
- Condensation may occur if the instrument is moved to another place where the ambient temperature is higher, or if the temperature changes rapidly. In such cases, allow the instrument adjust to the new environment for at least an hour before using the instrument.

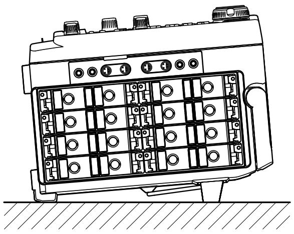
Do not install the instrument in the following places.

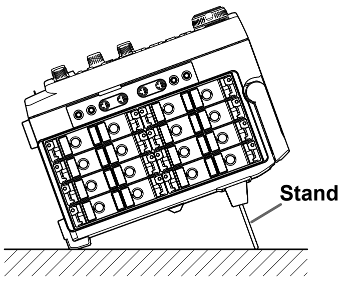
- Outdoors.
- In direct sunlight or near heat sources.
- Where the instrument is exposed to water or other liquids.
- Where an excessive amount of soot, steam, dust, or corrosive gas is present.
- Near strong magnetic field sources.
- Near high voltage equipment or power lines.
- Where the level of mechanical vibration is high.
- On an unstable surface.

Installation Position

Install the instrument so that it is flat or with the rear panel facing down. When using the stand as shown in the bottom right figure, push it out until it locks into place. Push the stand back in when you store the instrument.







WARNING

- When you put away the stand, be careful not to get your hand caught between the stand and the instrument.
- Handling the stand without firmly supporting the instrument can be dangerous. Please take the following precautions.
  - Only handle the stand when the instrument is on a stable surface.
  - Do not handle the stand when the instrument is tilted.
- Do not place the instrument in any position other than those shown in the above figures. Also, do not stack the instrument.

Rubber Stoppers

If the instrument is installed so that it is flat as shown in the above figure, rubber stoppers can be attached to the feet to prevent the instrument from sliding. One set of rubber stoppers (four stoppers) are included in the package.

3.3 Installing Input Modules

WARNING

- To prevent electric shock and damage to the instrument, be sure to turn the power off before you install or remove input modules.
- Check that the input cable is not connected to the input terminals before installing or removing the input module.
- To prevent electric shock and to satisfy the specifications, make sure to put the accessory cover plate on the slots that are not being used.

  Using the instrument without the cover plate allows the dust to enter the instrument and may cause malfunction due to the rise in temperature inside the instrument.
- If the input module happens to come out of the slot while it is in use, it may cause electric shock or cause damage to the instrument as well as the input module. Make sure to screw the input module in place at the two locations (top and bottom).
- There are protrusions in the slot. Do not put your hand in the slot. If you put your hand in the slot, the protrusions may cut your hand.

Precautions to Be Taken When Using the Modules

- Do not apply input voltage exceeding the maximum input voltage, withstand voltage, or allowable surge voltage.
- To avoid electric shock, be sure to ground the instrument.
- To prevent the possibility of electric shock, be sure to fasten the module screws. Failing to do so is extremely dangerous, because the electrical and mechanical protection functions will not be activated.
- Do not leave the instrument connected to devices in an environment that may be subject to voltage surges.
- When measuring high voltages using the 720210 (HS100M12), 701250 (HS10M12), or 701251 (HS1M16), use an isolated probe (the 700929 or 701947), 1:1 safety cable (a combination of the 701901 and 701954), or differential probe (700924).
- Be sure to connect the GND lead of the differential probe (the 700924) to the functional ground terminal of the DL850E/DL850EV before you connect to the device under measurement. High voltage may appear at the BNC connector of the differential probe.
- The protection functions and non-isolation functions of the 701255 (NONISO_10M12) are enabled when the module screws are tightened. It is extremely dangerous if you do not fasten the screws. Also, when you measure high voltages above 42 V, be sure to use the passive probe for the DL850E/DL850EV (the 701940).
- The BNC portion of the 10 MHz passive probe (701940) is metal, so if you use it with isolated input (the 720210 (HS100M12), 701250 (HS10M12), 701251 (HS1M16), 701275 (ACCL/VOLT), or 701280(FREQ)), for safety, be sure to only use it with voltages at or below 42 V. (Do not connect voltage above 42 V to both the High and Low sides.)
- When measuring high voltages using the 701267 (HV (with RMS)), use a measurement lead 758933 and alligator clip 701954.
- The measurement category of 701267 (HV (with RMS)) when used with 758933 measurement leads and 701954 alligator clips is 400V-CAT II on the low side and 700V-CAT II on the high side. Be careful because the overvoltage tolerance between the low and high sides is different.
- When measuring high voltages using the 701280 (FREQ), use an isolated probe (the 700929 or 701947).
- The protection functions and non-isolation functions of the 720230 (LOGIC) are enabled when the module screws are tightened. It is extremely dangerous if you do not fasten the screws. Also, be sure to only use a recommended YOKOGAWA logic probe (700986, 700987, 702911, or 702912) with the logic module.

Types of Input Modules

The following 14 types of input modules are available.

High-Speed 100 MS/s, 12-Bit Isolation Module	720210 (HS100M12)
High-Speed 10 MS/s, 12-Bit Isolation Module	701250 (HS10M12)
High-Speed High-Resolution 1 MS/s, 16-Bit Isolation Module:	701251 (HS1M16)
High-Speed 10 MS/s, 12-Bit Non-Isolation Module	701255 (NONISO_10M12)
High-Voltage 100 kS/s, 16-Bit Isolation Module (with RMS)	701267 (HV (with RMS))
Universal (Voltage/Temp.) Module	701261 (UNIVERSAL)
Universal (Voltage/Temp.) Module (with AAF)	701262 (UNIVERSAL (AAF))
Temperature, High Precision Voltage Isolation Module	701265 (TEMP/HPV)
Strain Module (NDIS)	701270 (STRAIN_NDIS)
Strain Module (DSUB, Shunt-Cal)	701271 (STRAIN_DSUB)
Acceleration/Voltage Module (with AAF)	701275 (ACCL/VOLT)
Frequency Module	701280 (FREQ)
16-CH Voltage Input Module	720220 (16CH VOLT)
16-CH Temperature/Voltage Input Module	720221 (16CH TEMP/VOLT)
Logic Input Module	720230 (LOGIC)
CAN Bus Monitor Module*	720240 (CAN MONITOR)
CAN & LIN Bus Monitor Module*	720241 (CAN & LIN)

* The CAN bus monitor module and CAN & LIN bus monitor module can be used on the DL850EV. It cannot be used on the DL850E.

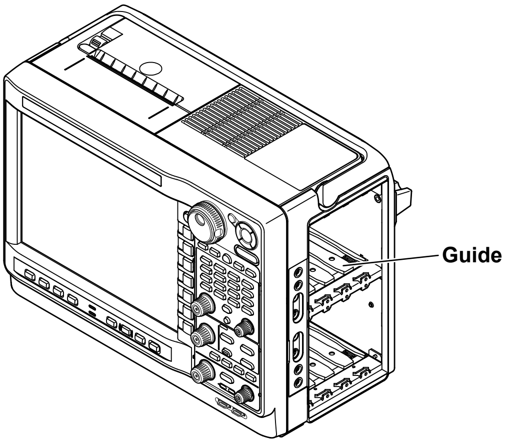
Precautions to Be Taken When Installing or Removing Input Modules

If you replace one installed input module with another, the settings for the channel will be reset to their defaults when the power is turned on. If you want to keep the settings, specify a save destination and save them.

Installation Procedure of Modules

1. Make sure that the power switch on the left side panel of the instrument is turned off.
2. Check the channel number displayed on the input module installation slot on the right side panel of the instrument, and then install the input module along the guide.

   Holding the handles on the top and bottom of the input module, press hard until it clicks in place. If there is a cover plate on the slot in which to install the module, remove the cover plate, first.
3. Firmly fasten the screws that came with the instrument in two places: the top and bottom of the input module. (screw tightening torque: 0.6 N•m)
4. Turn the instrument's power switch on.
5. In the overview screen, check that the name of the module that you installed is displayed correctly at the appropriate slot. If it is not correct, remove the module according to the steps in "Removal" shown below, and reinstall the module according to steps 1 to 3 shown above. To display the overview screen, see section 19.4, "Viewing System Information (Overview)," in the user's manual.



Note

- You can install up to four 720210 modules, and these modules must be installed in the top slots.
- You can install a total of two 720240 CAN bus monitor modules (CAN MONITOR) and 720241 CAN & LIN bus monitor modules (CAN & LIN). These monitor modules can only be installed in slots 7 and 8.

Removal

1. Make sure that the instrument’s power switch is off.
2. Loosen the two screws that are fastened to the input module.
3. Hold the two handles at the top and bottom of the input module, and pull it out.

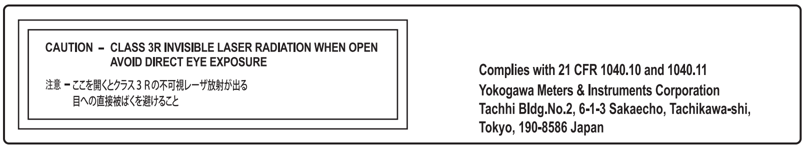
About the High-speed, 100 MS/s, 12-bit Isolated Module

Safety Precautions for Laser Products

The High-Speed 100 MS/s, 12-Bit Isolation Module (720210 (HS100M12)) uses an internal laser light source. The 720210 (HS100M12) is a class 1 laser product as defined by IEC60825-1: Safety of Laser Products—Part1: Equipment Classification.

High-Speed 100 MS/s, 12-Bit Isolation Module (720210 (HS100M12))

The following information is printed on the side.



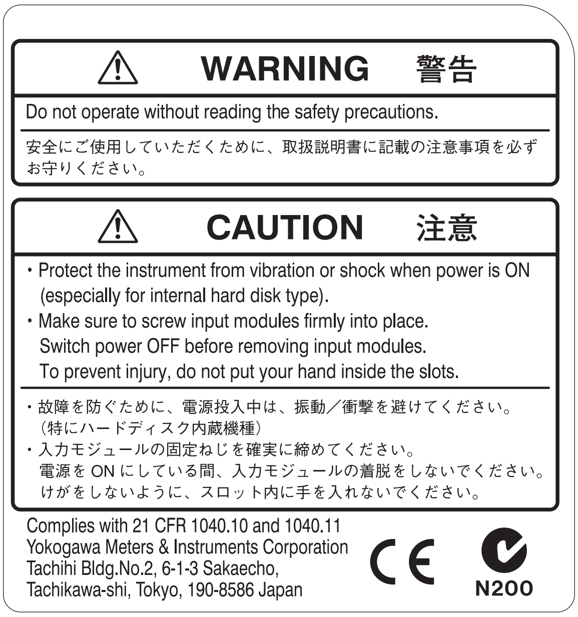
CAUTION – CLASS 3R INVISIBLE LASER RADIATION WHEN OPEN
AVOID DIRECT EYE EXPOSURE

注意 – ここを開くとクラス３Ｒの不可視レーザ放射が出る
目への直接被ばくを避けること

Complies with 21 CFR 1040.10 and 1040.11
Yokogawa Meters & Instruments Corporation
Tachhi Bldg.No.2, 6-1-3 Sakaecho, Tachikawa-shi,
Tokyo, 190-8586 Japan

DL850E/DL850EV

The following information is printed on the top.



WARNING 警告

Do not operate without reading the safety precautions.

安全にご使用していただくために、取扱説明書に記載の注意事項を必ずお守りください。

CAUTION 注意

- Protect the instrument from vibration or shock when power is ON (especially for internal hard disk type).
- Make sure to screw input modules firmly into place.
Switch power OFF before removing input modules.
To prevent injury, do not put your hand inside the slots.

- 故障を防ぐために、電源投入中は、振動／衝撃を避けてください。（特にハードディスク内蔵機種）
- 入力モジュールの固定ねじを確実に締めてください。
電源を ON にしている間、入力モジュールの着脱をしないでください。
けがをしないように、スロット内に手を入れないでください。

Complies with 21 CFR 1040.10 and 1040.11
Yokogawa Meters & Instruments Corporation
Tachihi Bldg.No.2, 6-1-3 Sakaecho,
Tachikawa-shi, Tokyo, 190-8586 Japan

N200

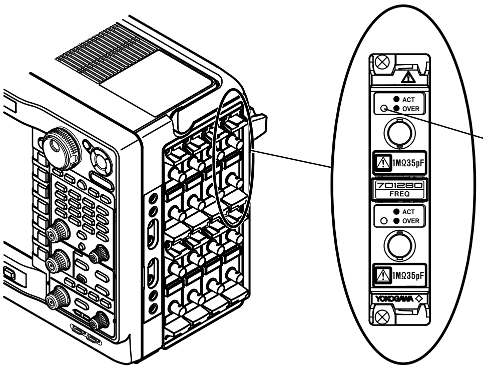
Laser Specifications

Center wavelength: 850 nm
Pulse width: ≤ 10 ms (100 MHz), ≤ 2.5 ns (2 GHz)
Output: ≤ 1 mW

If the instrument is used in a manner not specified in this manual, the protection provided by the instrument may be impaired. YOKOGAWA assumes no liability for the customer's failure to comply with these warnings and requirements.

LEDs on the Frequency Module

On the front panel of the frequency module (701280 (FREQ)) are LEDs for each channel. These LEDs allow you to check the input condition of the pulse.



LED
Green: Pulses are being received.
Red: The input voltage range has been exceeded.
Off: Pulses are not being received.

701280 (FREQ)

Note

- The LEDs on the frequency module illuminates in green when pulse is applied and red when the input voltage level is over range. It is independent of the start/stop condition of waveform acquisition of the DL850E/DL850EV.
- When the preset of the frequency module is set to EM Pickup (electromagnetic pickup), the LED will not illuminate in red when the range is exceeded.
  For information about presets, see section 1.7, "Configuring Frequency, Revolution, Period, Duty Cycle, Power Supply Frequency, Pulse Width, Pulse Integration, and Velocity Measurements," in the user's manual.

3.4 Connecting to a Power Supply and Turning the Power Switch On and Off

Before Connecting the Power

Make sure that you observe the following points before connecting the power. Failure to do so may cause electric shock or damage to the instrument.

⚠ **WARNING**

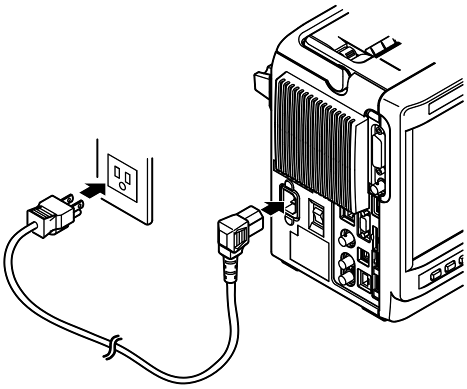
- Before connecting the power cord, ensure that the source voltage matches the rated supply voltage of the instrument and that it is within the maximum rated voltage of the provided power cord.
- Connect the power cord after checking that the power switch of the instrument is turned off.
- To prevent the possibility of electric shock or fire, be sure to use the power cord for the instrument that was supplied by YOKOGAWA.
- To avoid electric shock, be sure to ground the instrument. Connect the power cord to a three-prong power outlet with a protective earth terminal.
- Do not use an extension cord without a protective earth ground. Otherwise, the protection function will be compromised.
- If an AC outlet that conforms to the accessory power cord is unavailable and protective grounding cannot be furnished, do not use the instrument.

Connecting the Power Cord

1. Check that the power switch is off.
2. Connect the power cord plug to the power inlet on the left side panel.
3. Connect the other end of the cord to an outlet that meets the conditions below. Use the three-prong power outlet equipped with a protective earth terminal.

Rated supply voltage*	100 to 120 VAC/200 to 240 VAC
Permitted supply voltage range	90 to 132 VAC/198 to 264 VAC
Rated supply voltage frequency	50/60 Hz
Permitted supply voltage frequency range	48 to 63 Hz
Maximum power consumption	Approx. 200 VA max. (This value is for reference. When the built-in printer is not being used and there are 16 active channels provided by eight high-speed 10 MS/s 12-bit isolation modules, the maximum power consumption is 135 VA.)

* The instrument can use a 100 V or a 200 V power supply. The maximum rated voltage differs according to the type of power cord. Check that the voltage supplied to the DL850E/DL850EV is less than or equal to the maximum rated voltage of the provided power cord (see page iii) before using it.



Connecting the DC Power Supply to the DC Power Supply Model (/DC)

WARNING

- Connect the DC power cord after checking that the power switch of the instrument is turned OFF. If you connect the power cord with the power switch turned ON, sparks may be emitted and can lead to fire.
- To prevent the possibility of electric shock or fire, be sure to use a power cord and power connector that YOKOGAWA specifies.
- Make sure to perform protective earth grounding to prevent electric shock.

CAUTION

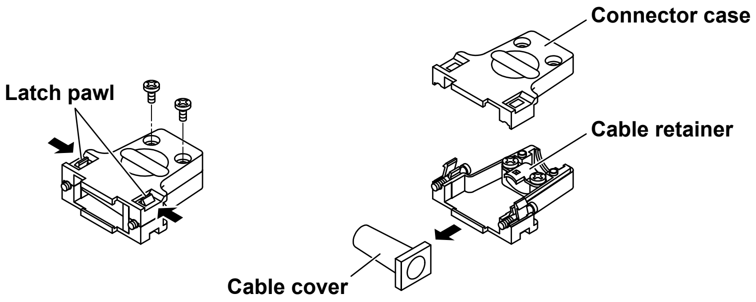
- There is a polarity to the DC power connector. Check the polarity when making a connection. If you have trouble connecting it, do not force it; check the connector direction.
- To prevent shorting the power supply, remove the power cord from the power supply when the power supply is not in use.

Creating the Power Cord

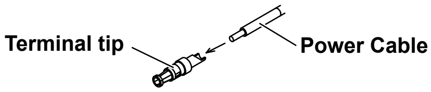
Create a power cord using the power connector that comes with the package. For the power cord, use a cable that is between AWG12 (conductive cross-sectional area of 3.3 mm^2) and AWG14 (conductive cross-sectional area of 2.1 mm^2) with an outer diameter less than or equal to 3.6 mm.

There are two types of terminal tips. Use the tip with a small diameter for the protective grounding terminal.

1. Remove the two screws from the DC power connector.
2. Press the latch pawl in the direction of the arrow as shown and remove the connector case. Take out the cable cover that is stored in the connector.

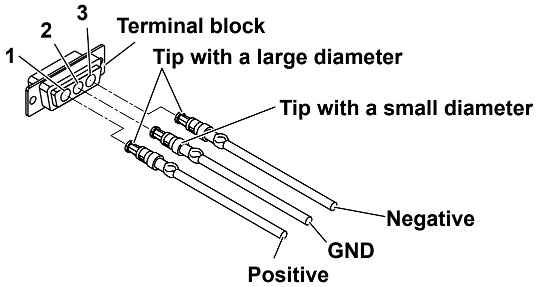


3. Remove the two cable retainer screws.
4. Run the cable through the cable cover.
5. Solder the power cable to the three terminal tips provided. Solder the protective grounding cable to the tip with the small diameter.



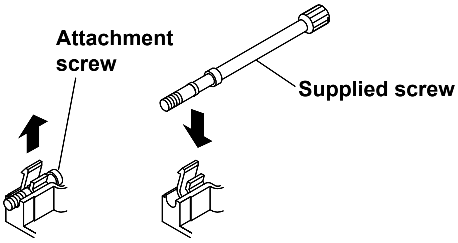
6. Insert the terminal tips into the terminal block as shown in the figure. The connector numbers and power polarities are listed below.

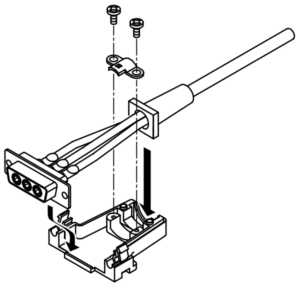
Terminal No.	Signal
1	Positive
2	Protective ground
3	Negative


1
2
3
Terminal block
Tip with a large diameter
Tip with a small diameter
Negative
GND
Positive

7. Replace the attachment screws with the supplied long screws as necessary. You can remove the attachment screws by pulling the screws in the direction of the arrow.

8. Attach the cable to the connector. Set the chip mount flange and cable cover flange in the connector case grooves. Secure the cable in place using the cable retainer.


Attachment screw
Supplied screw

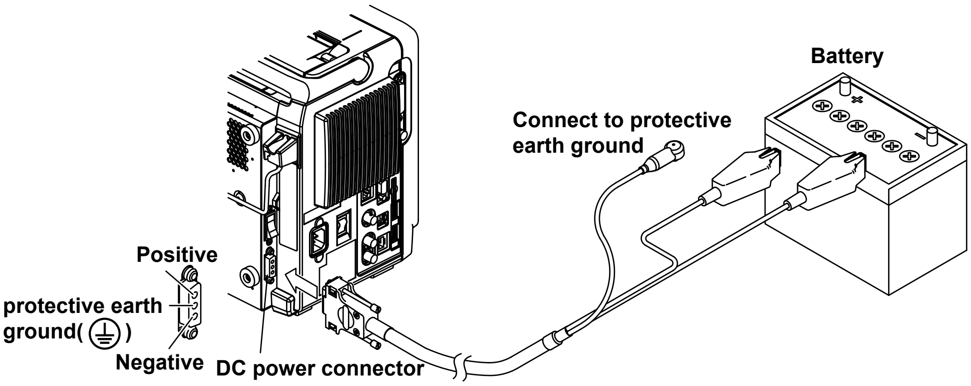


9. Put the connector case on and fasten it with screws.

Connecting to the Power Supply

Connect the power cord as shown in the figure below. The power supply must meet the following conditions:

Item	Description
Rated supply voltage	12 VDC
Permitted supply voltage range	10 to 18 VDC (at the DL850EV connector end)
Maximum power consumption	Approx. 150 VA Max. (135 VA when driving 16 channels with four High-Speed 100 MS/s, 12-Bit Isolation Modules and four High-Speed 10 MS/s 12-Bit Isolation Modules)


Battery
Connect to protective earth ground
Positive
protective earth ground(⏚)
Negative
DC power connector

Note

- If both AC power and DC power are supplied, AC power takes precedence.
- If both AC power and DC power are supplied and AC power is cut off, the power instantaneously switches to DC power.

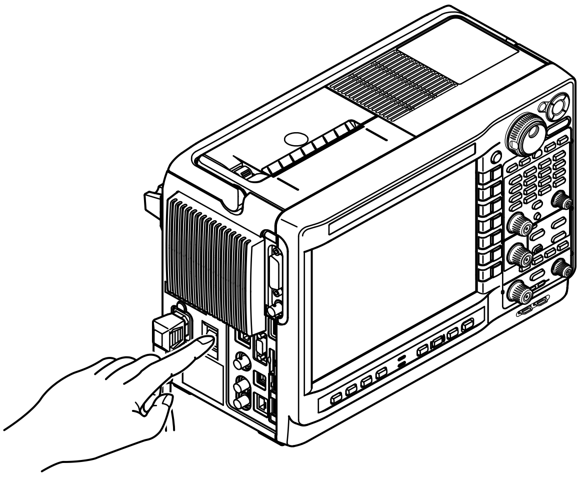
Turning the Power Switch On and Off

Before Turning On the Power, Check That:

- The instrument is installed properly (see section 3.2, “Installing the Instrument”).
- The power cord is connected properly (see page 3-9).

Turning the Power Switch On and Off

Flip the power switch on the left side panel to ON (|) to turn the instrument on, and to OFF (○) to turn the instrument off.



Turning ON/OFF the DC Power (/DC)

Before Turning On the Power, Check That:

- The instrument is installed properly (see section 3.2, “Installing the Instrument”).
- The power cord is connected properly (see page 3-9).

Turning the Power Switch On and Off

Flip the power switch on the left side panel to ON (|) to turn the instrument on, and to OFF (○) to turn the instrument off.

Note

If AC power is supplied and the main power switch to the AC power is ON, AC power is used.

Status Display of the DC Power Supply

The power supply status is indicated on the LED on the left side panel.

AC LED

LED Status	Description
Illuminated in green	Operating on AC power

DC LED

LED Status	Description
Illuminated in green	Operating on DC power (AC power is not connected) Operating on AC power, and the DC supply voltage is within the operating range (10 to 18 VDC)
Illuminated in red	Operating on DC power, and the DC supply voltage is outside the operating range
Illuminated in orange	DC power is turning ON/OFF repeatedly (internal protection circuit is tripping) Power is not supplied in this condition. This status is automatically cleared after 10 to 20 seconds.
Illuminated in red	Internal circuit operation failure. Repair is necessary.
Off	Operating on AC power, and the DC supply voltage is within the operating range (10 to 18 VDC) or the DC power is not supplied

Operations Performed When the Power Is Turned On

When the power switch is turned on, self testing and calibration start automatically. This lasts for approximately 30 seconds. When the DL850E/DL850EV starts normally, the waveform display screen appears. Check that the DL850E/DL850EV has started normally before you use it.

If the DL850E/DL850EV Does Not Start Normally When the Power Is Turned On

Turn off the power switch, and check the following items.

- Check that the power cord is securely connected.
- Check that the correct voltage is coming to the power outlet. → Page 3-9
- Initialize the settings to their factory defaults by turning on the power switch while holding down the RESET key. For details about initializing the settings, see section 4.6, “Initializing Settings.”

If the instrument still does not work properly, contact your nearest YOKOGAWA dealer for repairs.

Note

- After turning the power off, wait at least 10 seconds before you turn it on again.
- On the DC power supply option, repeatedly turning the power switch on and off will stop the power from being supplied because the internal protection will be activated. If you refrain from turning the power on or off for 10 to 20 seconds, the internal protection will be released, and power supply will be restored. The DC power supply LED lights in orange while power is not being supplied.
- It takes several seconds for the startup screen to appear.

Operations Performed When the Power Is Turned Off

When the power switch is turned off (or the power plug is removed), the instrument stores the current settings in its memory. This means that if you turn the power switch on and begin measurement, the instrument will perform measurements using the settings from immediately before the instrument was last turned off.

Note

The instrument stores the settings using an internal lithium battery. The battery lasts for approximately five years when the ambient temperature is 23°C. When the lithium battery voltage falls below a specified value and you turn on the power, a message (error 907) appears on the screen. If this message appears frequently, you need to replace the battery soon. Do not try to replace the battery yourself. Contact your nearest YOKOGAWA dealer to have the battery replaced.

To Make Accurate Measurements

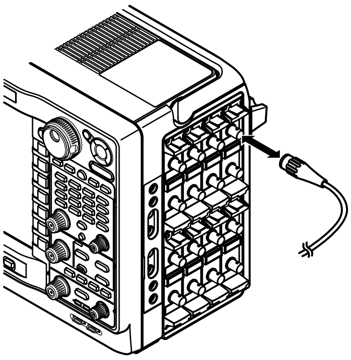
- After turning on the power switch, wait at least 30 minutes to allow the instrument to warm up.
- Perform calibration after the instrument has warmed up (see section 4.7 for details). If auto calibration is turned on, auto calibration is executed when you change the Time/div setting or start waveform acquisition.

3.5 Connecting Probes

Connecting Probes

Connect the probes (or other input cables such as BNC cables) to any of the input terminals of the following modules. The input impedance is 1 MΩ ± 1 % and approximately 35 pF.

- High-Speed 100 MS/s, 12-Bit Isolation Module: 720210 (HS100M12)
- High-Speed 10 MS/s, 12-Bit Isolation Module: 701250(HS10M12)
- High-Speed High-Resolution 1 MS/s, 16-Bit Isolation Module: 701251 (HS1M16)
- High-Speed 10 MS/s, 12-Bit Non-Isolation Module: 701255 (NONISO_10M12)
- Acceleration/Voltage Module (with AAF): 701275 (ACCL/VOLT)
- Frequency Module: 701280 (FREQ)



WARNING

- When connecting a device under measurement to the instrument, be sure to turn off the device. It is extremely dangerous to connect or remove measurement leads while the device under measurement is on.

Precautions to Be Taken When Using the Modules

- Do not apply input voltage exceeding the maximum input voltage, withstand voltage, or allowable surge voltage.
- To avoid electric shock, be sure to ground the instrument.
- To prevent the possibility of electric shock, be sure to fasten the module screws. Otherwise, the electrical protection function and the mechanical protection function will not be activated.
- Do not leave the instrument connected to devices in an environment that may be subject to voltage surges.
- Use only specified cables. It is extremely dangerous to use cables that do not meet the safety standards. (Especially when you are handling high voltages of 42 V or more.)
- When measuring high voltages using the 720210 (HS100M12), 701250 (HS10M12), or 701251 (HS1M16), use an isolated probe (the 700929 or 701947), 1:1 safety cable (a combination of the 701901 and 701954), or differential probe (700924).
- The BNC portion of the 10 MHz passive probe (701940) is metal, so if you use it with isolated input (the 720210 (HS100M12), 701250 (HS10M12), 701251 (HS1M16), 701275 (ACCL/VOLT), or 701280(FREQ)), for safety, be sure to only use it with voltages at or below 42 V. (Do not connect voltage above 42 V to both the High and Low sides.)For non-isolated inputs (701255 (NONISO_10M12), etc.), fasten the module screws.
- When you apply high voltages to the 701280 (FREQ), use an isolated probe (the 700929 or 701947).

In Using the High Voltage Differential Probes

Be sure to connect the GND lead of a differential probe (the 700924 or 700925) to the functional ground terminal on the right side panel of the instrument. Otherwise, high voltage may appear at the BNC connector making it dangerous.

Maximum Input Voltages and Maximum Allowable Common Mode Voltages for the Modules

Applying a voltage exceeding the value indicated below may damage the input section. If the frequency is above 1 kHz, damage may occur even when the voltage is below this value.

- **For the 720210 (HS100M12)**

  Maximum input voltage (at a frequency of 1 kHz or less)
  - When used with the 700929 (10:1) isolated probe or the 701947 (100:1) isolated probe.[1]
    1000 V (DC + ACpeak) CAT II
  - With the safety cable (1:1; a combination of the 701901 and 701954)[5]
    200 V (DC + ACpeak)
  - Direct input (cable that does not comply with the safety standards)[9]
    42V (DC + ACpeak)

  Maximum allowable common mode voltage (at a frequency of 1 kHz or less)
  - When used with the 700929 (10:1) isolated probe or the 701947 (100:1) isolated probe.[2]
    Or when used with the safety cable (1:1; a combination of the 701901 and 701954).[8]
    1000 Vrms (CAT II)
  - Direct input (cable that does not comply with the safety standards)[10]
    42V (DC + ACpeak) (CAT II, 30 Vrms)

- **For the 701250 (HS10M12)**

  Maximum input voltage (at a frequency of 1 kHz or less)
  - When used with the 700929 (10:1) isolated probe or the 701947 (100:1) isolated probe.[1]
    600 V (DC + ACpeak)
  - Safety cable (1:1) (combined with 701901+701954)[5]
    200 V (DC + ACpeak) (as a value that meets the safety standard)
    250 V (DC + ACpeak) (maximum allowable voltage, as a value that does not damage the instrument when applied)
  - Direct input (cable that does not comply with the safety standards)[9]
    42V (DC + ACpeak)

  Maximum allowable common mode voltage (at a frequency of 1 kHz or less)
  - When used with the 700929 (10:1) isolated probe or the 701947 (100:1) isolated probe.[2]
    Or when used with the safety cable (1:1; a combination of the 701901 and 701954).[8]
    400 Vrms (measurement category Other (O)), 300 Vrms (CAT II)
  - Direct input (cable that does not comply with the safety standards)[10]
    42 V (DC + ACpeak) (CAT II, 30 Vrms)

- **For the 701251 (HS1M16)**

  Maximum input voltage (at a frequency of 1 kHz or less)
  - When used with the 700929 (10:1) isolated probe or the 701947 (100:1) isolated probe.[1]
    600 V (DC + ACpeak)
  - Safety cable (1:1) (combined with 701901 + 701954)[5]
    140 V (DC + ACpeak)
  - Direct input (cable that does not comply with the safety standards)[9]
    42V (DC + ACpeak)

  Maximum allowable common mode voltage (at a frequency of 1 kHz or less)
  - When used with the 700929 (10:1) isolated probe or the 701947 (100:1) isolated probe.[2]
    Or when used with the safety cable (1:1; a combination of the 701901 and + 701954).[8]
    400 Vrms (measurement category Other (O)), 300 Vrms (CAT II)
  - Direct input (cable that does not comply with the safety standards)[10]
    42 V (DC + ACpeak) (CAT II, 30 Vrms)

- **For the 701255 (NONISO_10M12)**

  This module is non-isolated. Be sure to fasten the module screws when measuring a voltage above 42 V on this module. In addition, use the 701940 (10:1) dedicated non-isolated passive probe.

  Maximum input voltage (at a frequency of 1 kHz or less)
  - Combined with the 701940 (10:1) passive probe
    600 V (DC + ACpeak)
  - Direct input (cable that does not comply with the safety standards)[9]
    200 V (DC + ACpeak) (as a value that meets the safety standard)
    250 V (DC + ACpeak) (maximum allowable voltage, as a value that does not damage the instrument when applied)

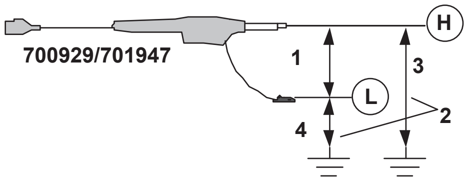
- **For the 701275 (ACCL/VOLT)**
  Maximum input voltage (at a frequency of 1 kHz or less)
  - Combined with the 701940 (10:1) passive probe[11] or direct input (cable that does not comply with the safety standards)[9]
    42 V (DC + ACpeak)

  Maximum allowable common mode voltage (at a frequency of 1 kHz or less)
  - Combined with the 701940 (10:1) passive probe[12] or direct input (cable that does not comply with the safety standards)[10]
    42 V (DC + ACpeak) (CAT II, 30 Vrms)

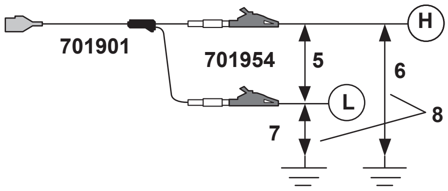
- **For the 701280 (FREQ)**
  Maximum input voltage (at a frequency of 1 kHz or less)
  - When used with the 700929 (10:1) isolated probe or the 701947 (100:1) isolated probe.[1]
    420 V (DC + ACpeak)
  - Safety cable (1:1) (combined with 701901 + 701954)[5] or direct input (cable that does not comply with the safety standards)[9]
    42 V (DC + ACpeak)

  Maximum allowable common mode voltage (at a frequency of 1 kHz or less)
  - When used with the 700929 (10:1) isolated probe or the 701947 (100:1) isolated probe.[2]
    300 Vrms (CAT II)
  - Safety cable (1:1) (combined with 701901 + 701954)[8] or direct input (cable that does not comply with the safety standards)[10]
    42 V (DC + ACpeak) (CAT II, 30 Vrms)

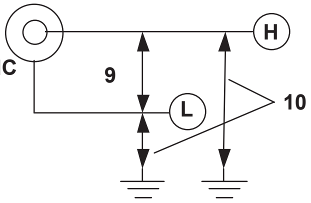
With the 700929 or 701947



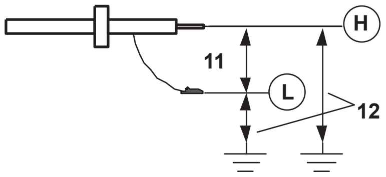
With the 701901 and 701954



Direct input (cable that does not comply with the safety standards)

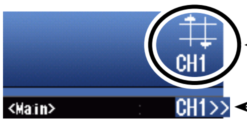


With the 10:1 passive probe (701940)



Over-Range Indication

If over-range is indicated, the DL850E/DL850EV may be receiving a voltage higher than the observed waveform or measured waveform values. To prevent electric shock, change the vertical scale with the SCALE knob so that the entire amplitude of the waveform is displayed within the waveform display area, and check the input voltage level.



Over-range indication
Indicates the number of the channel that over-range is occurring on.

Channel indication when over-range is occurring on multiple channels
Indicates the smallest number among the channels that over-range is occurring on.

Precautions to Be Taken When Connecting Probes

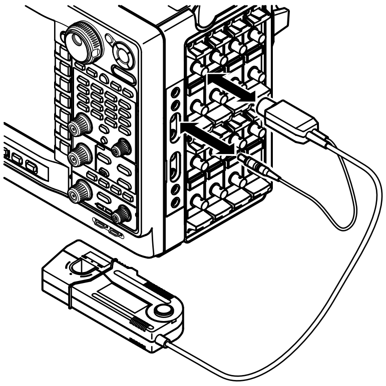
- When connecting a probe to the instrument for the first time, perform phase correction of the probe as described in section 3.6, “Compensating the Probe (Phase Correction).” Failure to do so will cause unstable gain across different frequencies, thereby preventing correct measurement. Make the phase correction on each channel to which the probe is to be connected.
- You cannot perform phase correction of the probe on the frequency module (701280(FREQ)). When connecting a probe to the 701280 (FREQ), first perform phase correction on the probe using another module.
- If the object to be measured is connected to the instrument directly, without using a probe, a correct measurement cannot be performed due to the input impedance. Please be aware of this.
- Please be aware that if you use a voltage probe that is not an isolated probe (the 700929 or 701947) and whose attenuation is not 1:1, 10:1, 100:1, or 1000:1, the correct measured values cannot be displayed.
- Follow the instructions given in section 1.1, “Configuring Voltage Measurements,” in the user’s manual to set the probe attenuation (type) to match the actual value using the setup menu. If they do not match, measured values cannot be read correctly.

Connecting Current Probes

When using current probes made by YOKOGAWA,* use the probe power supply (optional) on the right side panel of the DL850E/DL850EV.

* YOKOGAWA current probes: the 700937, 701930, 701931, and 701933

For details on the connection procedure, see the manual that came with the current probe.

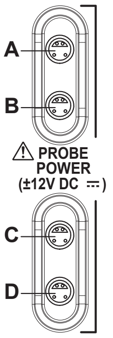


CAUTION

Do not use the probe power supply terminals (optional) on the right side panel of the DL850E/DL850EV for purposes other than supplying power to the current probes. Also, be sure to use only the number of probes allowed. Otherwise, the DL850E/DL850EV or the devices connected to them may get damaged.

Precautions to Be Taken When Using Current Probes

When connecting the current probe to the probe power supply terminal on the right side panel, make sure that the current does not exceed the range shown below. Otherwise, the DL850E/DL850EV operation may become unstable due to the activation of the excessive current protection circuit of the power supply.



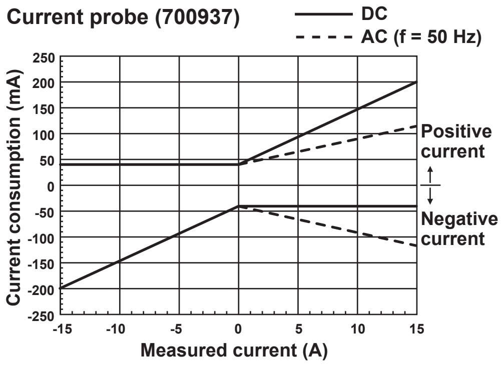
If the terminals are named A through D

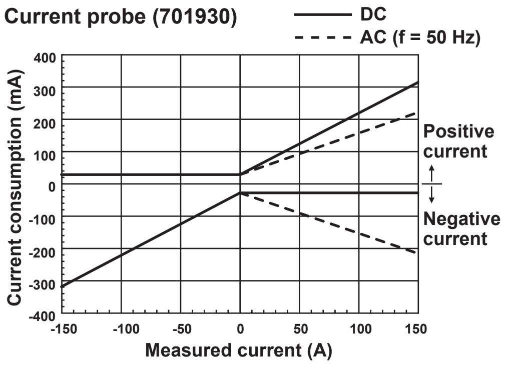
(Total current consumption for A through D) ≤ 1 A

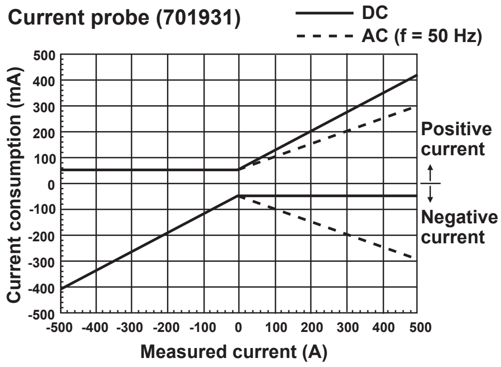
Specifications of the Probe Power Supply Terminals (Optional)

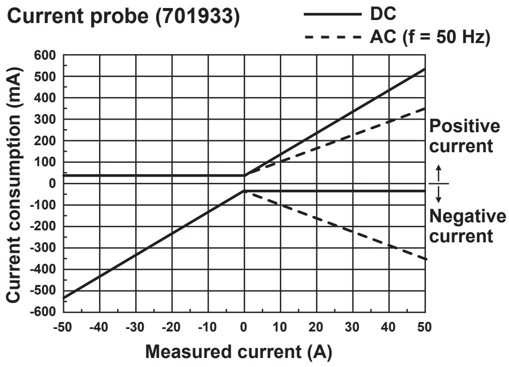
Item	
Number of probes that can be used	4
Probes that can be used	Current probe (700937, 701930, 701931, and 701933)
Number of current probes that can be used	700937 (15 A): Up to 4 701930 (150 A): Up to 2 701931 (500 A): Up to 1 701933 (30 A): Up to 2
Supply voltage	±12 V, four outputs (up to 1 A total current)

When using the current probe, the number of probes that can be used is limited by the current generated by the device under measurement (current measured by the current probe). The measured versus consumed current characteristics of current probes that can be connected to the instrument are indicated below.


Current probe (700937)


Current probe (701930)


Current probe (701931)

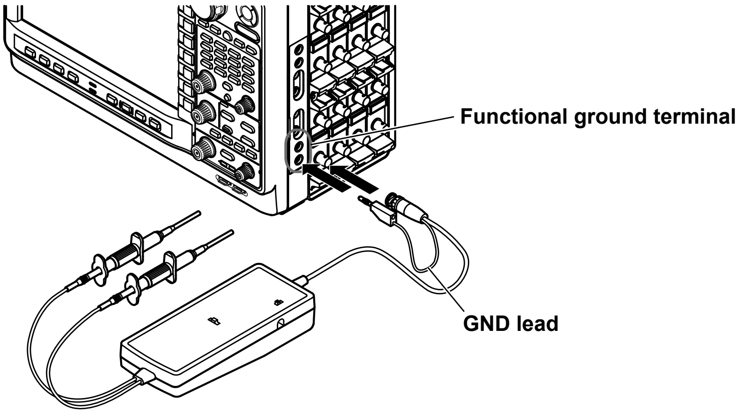

Current probe (701933)

For details about each current probe, contact your nearest YOKOGAWA dealer.

Connecting Differential Probes (700924/700925/701926)

When using differential probes (700924/700925/701926) made by YOKOGAWA, connect the BNC output connector to the input terminal of the oscilloscope. Also, be sure to connect the GND lead to the functional ground terminal of the DL850E/DL850EV. If necessary, use the auxiliary grounding lead extension. A measurement of 1400 Vpeak is possible by connecting the GND lead to the DL850E/DL850EV.

For details on the connection procedure, see the manual that came with the differential probe.



WARNING

In Using the High Voltage Differential Probes

Be sure to connect the GND lead of a differential probe (700924/700925/701926) to the functional ground terminal on the right side panel of the DL850E/DL850EV. Otherwise, high voltage may appear at the BNC connector making it dangerous. Also, be sure to connect the GND lead to the DL850E/DL850EV before you connect to the device under measurement.

3.6 Correcting the Probe Phase

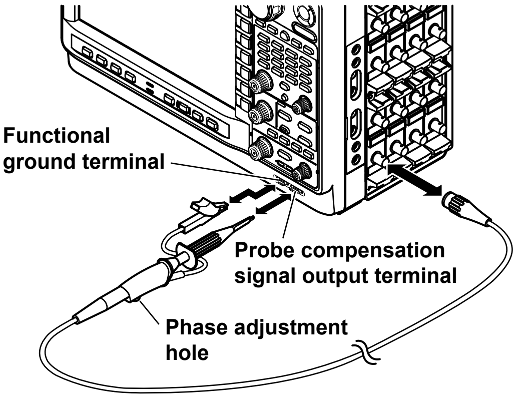
For the following modules, always correct the probe phase before you use a probe for measurement.

- High-Speed 100 MS/s, 12-Bit Isolation Module: 720210 (HS100M12)
- High-Speed 10 MS/s, 12-Bit Isolation Module: 701250 (HS10M12)
- High-Speed High-Resolution 1 MS/s, 16-Bit Isolation Module: 701251 (HS1M16)
- High-Speed 10 MS/s, 12-Bit Non-Isolation Module: 701255 (NONISO_10M12)
- Acceleration/Voltage Module (with AAF): 701275 (ACCL/VOLT)
- Frequency Module: 701280 (FREQ)

CAUTION

Do not apply external voltage to the probe compensation signal output terminal. This may cause damage to the internal circuitry.

1. Turn on the power switch.
2. Connect the probe to a signal input terminal (the terminal that you will actually apply the signal to measure to).
3. Connect the tip of the probe to the probe compensation signal output terminal on the front panel of the instrument, and connect the ground wire to the functional ground terminal.
4. Follow the instructions in section 4.5, “Performing Auto Setup,” to perform auto setup on the probe.
5. Insert a screwdriver into the phase adjustment hole, and turn the variable capacitor so that the displayed waveform is an appropriate square wave.


Functional ground terminal
Probe compensation signal output terminal
Phase adjustment hole

Necessity of Phase Correction of the Probe

If the probe’s input capacitance is not within the appropriate range, the gain will not be steady in relation to the frequency, and waveforms will not be displayed correctly. Also, because the input capacitance is not the same for each probe, the probe’s have variable capacitors (trimmers) that need to be adjusted. This adjustment is referred to as phase correction.

Always correct the phase of a probe that you are using for the first time.

Also, because the appropriate input capacitance range is different for each channel, you need to perform phase correction when you change the channel that a probe is connected to.

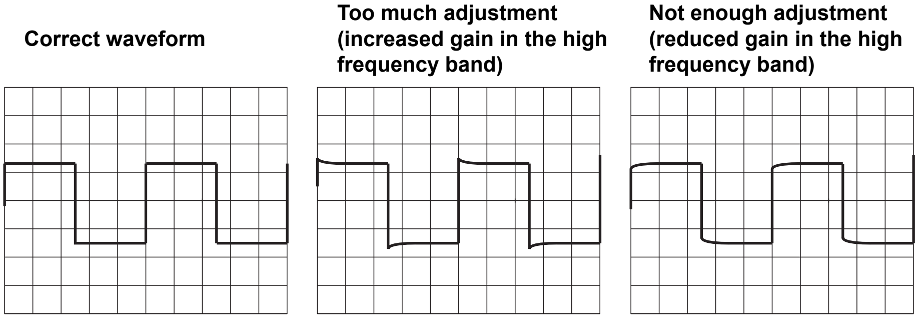
Phase Compensation Signal

The instrument generates the following square wave signal from the COMP signal output terminal.

Frequency: 1 kHz ± 1%

Computation: 1 V ± 10 %

Differences in the Waveform due to the Phase Correction of the Probe


Correct waveform
Too much adjustment (increased gain in the high frequency band)
Not enough adjustment (reduced gain in the high frequency band)

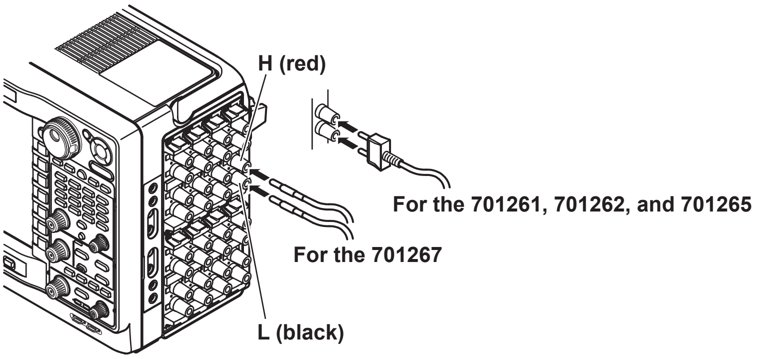
Notes about Using Probes with the Frequency Module (701280 (FREQ))

You cannot perform phase correction on a probe connected to the frequency module. To use a probe with the frequency module, first perform phase correction on the probe using another module.

3.7 Connecting Measurement Leads

Connecting Measurement Leads

When you measure voltage using the 701261 (UNIVERSAL), 701262 (UNIVERSAL (AAF)), 701267 (HV (with RMS)), and 701265 (TEMP/HPV), connect the measurement leads of a plug-in type terminal to the input terminal.



WARNING

- When connecting a device under measurement to the instrument, be sure to turn off the device. It is extremely dangerous to connect or remove measurement leads while the device under measurement is on.
- When measuring high voltages, do not connect a plug-in type terminal with exposed conducting parts to the input terminal to be used as a measurement lead. It is very dangerous, if the connector comes loose.

Precautions to Be Taken When Using the Modules

- To prevent the possibility of electric shock, always connect measurement leads that match the voltage range that you are measuring to the signal input terminals of the 701261 (UNIVERSAL), 701262 (UNIVERSAL (AAF)), 701267 (HV (with RMS)), and 701265 (TEMP/HPV).
- When measuring high voltages using the 701267 (HV (with RMS)), use a measurement lead 758933 and alligator clip 701954.

Maximum Input Voltages and Maximum Allowable Common Mode Voltages for the Modules

Applying a voltage exceeding the value indicated below may damage the input section. If the frequency is above 1 kHz, damage may occur even when the voltage is below this value.

- **For the 701261, 701262, and 701265**
  - Maximum input voltage (across the input terminals, H and L,[1] at a frequency of 1 kHz or less)
    42 V (DC+ACpeak)
  - Maximum allowable common mode voltage (across the input terminals, H or L, and earth,[2] at a frequency of 1 kHz or less)
    42 V (DC + ACpeak) (CAT II, 30 Vrms)

- **For the 701267 (HV (with RMS))**

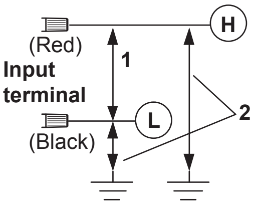
  Maximum input voltage (at a frequency of 1 kHz or less)

  - Combination of 758933 measurement leads and 701954 alligator clips[3]
    850 V (DC + ACpeak)
  - Direct input (cable that does not comply with the safety standards)[6]
    42 V (DC + ACpeak)

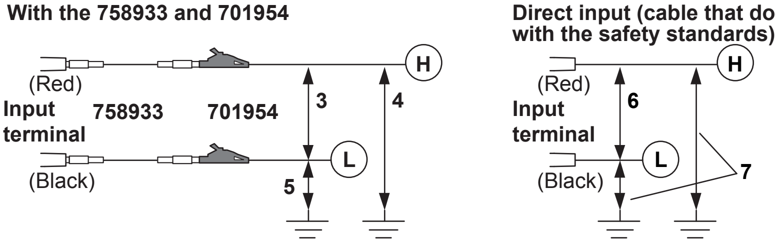
  Maximum allowable common mode voltage (at a frequency of 1 kHz or less)

  - Combination of 758933 measurement leads and 701954 alligator clips[5]
    (Use caution because the overvoltage tolerance differs between the low and high sides.)
    700 Vrms (CAT II) on the H side,[4] 400 Vrms (CAT II)[5] on the L side
  - Direct input (cable that does not comply with the safety standards)[7]
    42 V (DC + ACpeak) (CAT II, 30 Vrms)

For the 701261, 701262, 701265



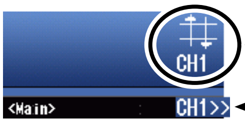
For the 701267


With the 758933 and 701954

Direct input (cable that does not comply with the safety standards)

Over-Range Indication

If over-range is indicated, the DL850E/DL850EV may be receiving a voltage higher than the observed waveform or measured waveform values. To prevent electric shock, change the vertical scale with the SCALE knob so that the entire amplitude of the waveform is displayed within the waveform display area, and check the input voltage level.



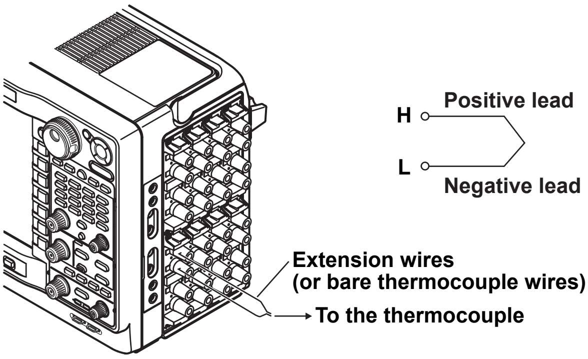
Over-range indication
Indicates the number of the channel that over-range is occurring on.

Channel indication when over-range is occurring on multiple channels
Indicates the smallest number among the channels that over-range is occurring on.

3.8 Connecting Thermocouples

Connecting Thermocouples

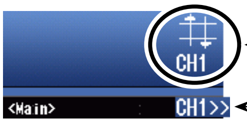
If you are connecting the compensation lead of the thermocouple to the input terminal (binding post terminal) of the 701261 (UNIVERSAL), 701262 (UNIVERSAL (AAF)), or 701265 (TEMP/HPV), loosen the terminal knob, pass the lead through the terminal, and tighten the knob.



WARNING

Over-Range Indication

If over-range is indicated, the DL850E/DL850EV may be receiving a voltage higher than the observed waveform or measured waveform values. To prevent electric shock, change the vertical scale with the SCALE knob so that the entire amplitude of the waveform is displayed within the waveform display area, and check the input voltage level.



Over-range indication
Indicates the number of the channel that over-range is occurring on.

Channel indication when over-range is occurring on multiple channels
Indicates the smallest number among the channels that over-range is occurring on.

CAUTION

- The 701261 (UNIVERSAL), 701262 (UNIVERSAL (AAF)), or 701265 (TEMP/HPV) is isolated from the DL850E/DL850EV. However, applying a voltage exceeding the value below may damage the input section. If the frequency is above 1 kHz, damage may occur even when the voltage is below this value.
  Maximum input voltage (across the input terminals, H and L, at a frequency of 1 kHz or less)
    42 V (DC + ACpeak)
  Maximum allowable common mode voltage (across the input terminal L and earth at a frequency of 1 kHz or less)
    42 V (DC + ACpeak) (CAT II, 30 Vrms)
- Correct measurements cannot be obtained when the positive and negative thermocouple leads are connected in reverse.
- Immediately after connecting the thermocouple, the heat balance may be disturbed at the input terminal section and may cause measurement errors. Therefore, wait about ten minutes before making a measurement.
- In an environment where the air from the air conditioning is directly applied to the input terminals or where there are effects from a heat source, the heat balance may be disturbed at the input terminal section and cause measurement errors.
  When making measurements in this type of environment, take preventive measures such as changing the position.

3.9 Connecting Bridgeheads

Strain is measured by connecting a strain gauge bridge (bridge head) or a strain gauge transducer to the strain module.
This section will mainly describe the procedures and precautions related to the connection of the bridge head (Model 701955/701956/701957/701958). For the connection of other strain gauge bridges or strain gauge transducers, see the respective manuals.

CAUTION

Only connect a strain gauge bridge (bridge head) or a strain gauge transducer to the strain module. Connecting other devices or applying a voltage that exceeds the values indicated below to the strain module may damage the input section.

- Maximum input voltage (between Input+ and Input–)
  10 V (DC + ACpeak)
- Maximum allowable common mode voltage (between each terminal and earth ground)
  42 V (DC + ACpeak) (CAT II, 30 Vrms)

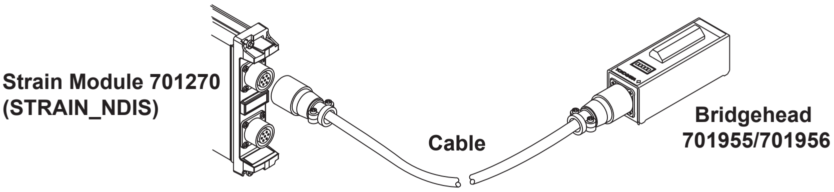
Connecting the Strain Gauge

The bridge head (701955/701956/701957/701958) supports six types of connection methods: single-gauge method, single-gauge three-wire method, adjacent-side two-gauge method, opposite-side two-gauge method, opposite-side two-gauge three-wire method, and four-gauge method. For details, see the manual that came with the bridge head (701955/701956/701957/701958).
If you are using a strain gauge bridge or a strain gauge transducer other than the bridge head (701955/701956/701957/701958), see the respective manuals.

Connecting the Strain Module and the Bridge Head

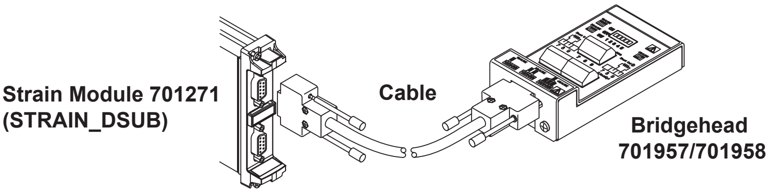
When Using the Strain Module (701270) and the Bridge Head (701955/701956)

Using the cable that came with the bridge head (701955/701956), connect the Strain Module (701270) and the bridge head.



When Using the Strain Module (701271) and the Bridge Head (701957/701958)

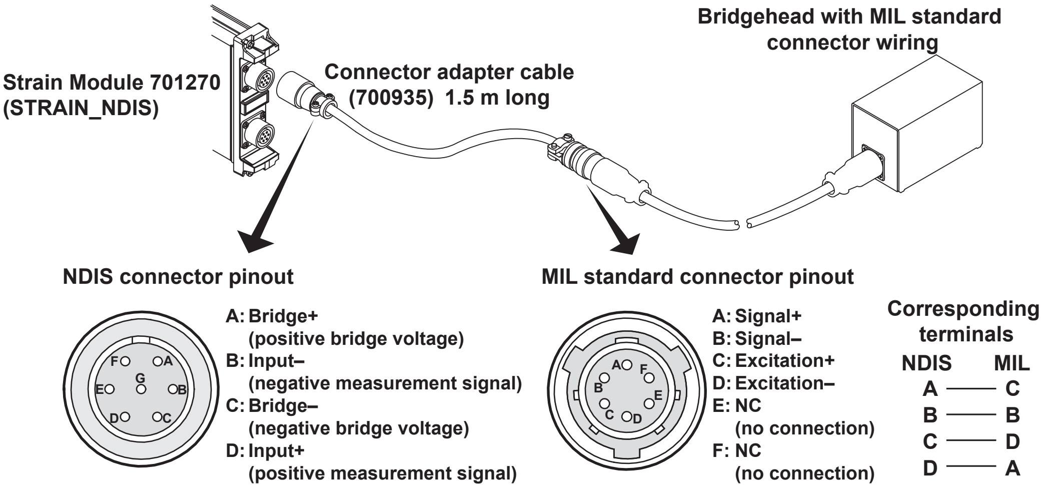
Using the cable that came with the bridge head (701957/701958), connect the Strain Module (701271) and the bridge head.



When Using a Bridge Head with a MIL Standard (MIL-C-26482) Connector Wiring

The connector on the Strain Module (701270) is a NDIS connector.* Use a connector adapter cable (700935) by YOKOGAWA to make a MIL-NDIS conversion and connect to the Strain Module (701270).

* Connector recommended by JSNDI (Japanese Society for Non-Destructive Inspection)


Bridgehead with MIL standard connector wiring
Strain Module 701270 (STRAIN_NDIS)
Connector adapter cable (700935) 1.5 m long
NDIS connector pinout
MIL standard connector pinout
F
A
G
E
B
D
C
A
F
B
E
C
D

NDIS connector pinout

- A: Bridge+ (positive bridge voltage)
- B: Input– (negative measurement signal)
- C: Bridge– (negative bridge voltage)
- D: Input+ (positive measurement signal)
- E: Floating common
- F: Sense+ (positive bridge voltage sensing)
- G: Sense– (negative bridge voltage sensing)

MIL standard connector pinout

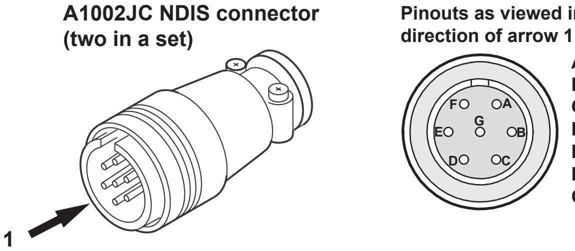
- A: Signal+
- B: Signal–
- C: Excitation+
- D: Excitation–
- E: NC (no connection)
- F: NC (no connection)

Corresponding terminals

NDIS	MIL
A	C
B	B
C	D
D	A

When Using the A1002JC Connector by YOKOGAWA

You can create your own cable by using the YOKOGAWA A1002JC connector that is compatible with the strain module and use the cable to connect a strain gauge bridge or a strain gage transducer to the strain module.


A1002JC NDIS connector (two in a set)
Pinouts as viewed in the direction of arrow 1
1
F
A
G
E
B
D
C

- A: Bridge+ (positive bridge voltage)
- B: Input– (negative measurement signal)
- C: Bridge– (negative bridge voltage)
- D: Input+ (positive measurement signal)
- E: Floating common
- F: Sense+ (positive bridge voltage sensing)
- G: Sense– (negative bridge voltage sensing)

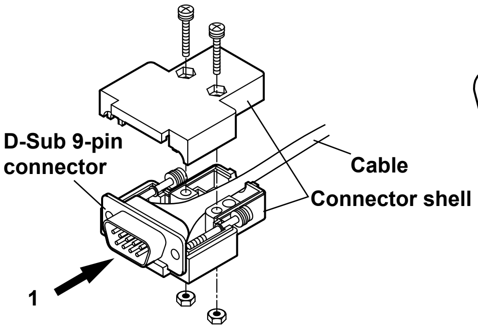
Note

- The connector shell is connected to the case potential of the DL850E/DL850EV.
- Each of the signals from A to G is isolated within the module.
- When creating your own cable, we recommend that you use a shielded cable in order to shut out external noise.

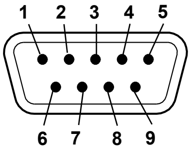
CAUTION

Take extra care when wiring the connectors. If the wiring is shorted or incorrect, it can damage the DL850E/DL850EV or other instruments that are connected to the DL850E/DL850EV.

Pinout of the D-Sub Connector


D-Sub 9-pin connector
Cable
Connector shell
1

As viewed in the direction of arrow 1



- 1: Floating common
- 2: Sense– (negative bridge voltage sensing)
- 3: Shuntcal– (negative shunt signal)
- 4: Shuntcal+ (positive shunt signal)
- 5: Sense+ (positive bridge voltage sensing)
- 6: Bridge– (negative bridge voltage)
- 7: Input– (negative measurement signal)
- 8: Input+ (positive measurement signal)
- 9: Bridge+ (positive bridge voltage)

3.10 Connecting a Logic Probe to the Logic Input Module

To measure logic signals, connect a logic probe (the 702911, 702912, 700986, or 700987) to a logic input module (the 720230).

CAUTION

- Applying a voltage greater than the limits listed below may damage the logic probe or the instrument. For frequencies above 1 kHz, damage may occur even if the voltage is less than the limits listed below.
  Maximum input voltage (at a frequency of 1 kHz or less)
  - Logic probes 702911 and 702912: 35 V
  - High-speed logic probe 700986: 42 V (DC + ACpeak)
  - 700987 isolated logic probe: 250 Vrms (however, ACpeak must be less than 350 V, and DC must be less than 250 V)
- For logic probes 702911 and 702912 and high-speed logic probe 700986, the eight input lines of a single pod share the same ground. Also, the instrument's ground and the grounds of each pod are connected. Do not apply signals with different common voltages to each input line. Doing so may damage the instrument, connected logic probes, and connected devices.
- The input terminals of an isolated logic probe are isolated from each other and from the DL850E/DL850EV.
- Turn off the DL850E/DL850EV before you connect or remove a 26-pin connector from the logic signal input connector.
- Do not stack the isolated logic probes during use. Also, allow enough space around the probes to avoid a temperature increase inside the probes.
- Do not use the YOKOGAWA 700985 logic probe with the DL850E/DL850EV. The 700985 is shaped so that it can be connected to the logic signal input connector of the DL850E/DL850EV, but it is not electrically compatible with the DL850E/DL850EV, so connecting the two could damage the DL850E/DL850EV or the 700985.

About the Logic Probe

Types of Logic Probes

YOKOGAWA provides the following four types of probes (as accessories) for connecting to the logic signal input connector of the DL850E/DL850EV.

- High-Speed Logic Probe (700986)
- Isolated Logic Probe (700987)
- 1 m Logic Probe (702911)
- 3 m Logic Probe (702912)

Types of Measurement Leads That Can Be Used

Use the following leads to connect to the point of measurement.

Connecting Leads That Can Be Used with Logic Probes 702911, 702912, and 700986

The following two types are available.

- Connecting lead (alligator clip, parts No. B9879PX)
  This lead is primarily for connecting to contact circuits. The lead consists of 8 signal lines (red) and 8 earth lines (black).
- Connecting lead (IC clip, parts No. B9879KX)
  This lead is primarily for connecting to electronic circuits. The lead consists of 8 signal lines (red) and 2 earth lines (black).

Types of Measurement Leads That Can Be Used on the Isolated Logic Probe (700987)

Use the following measurement lead.

- For measuring voltages of 42 V or more: Measurement lead for isolation logic (758917)
  An alligator adapter (758922), alligator adapter (758929), or alligator clip (dolphin type, 701954) is needed to make measurements.

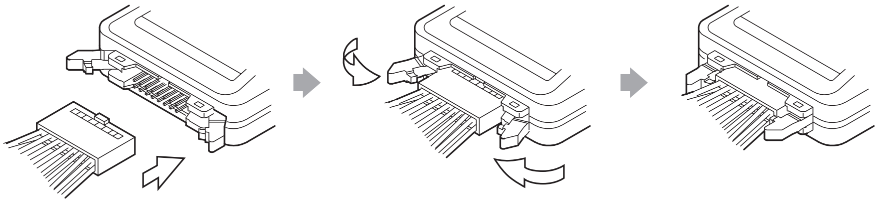
Note

Do not modify the connecting leads. Doing so may degrade their specifications.

Connecting Logic Probes

Connecting Logic Probes 702911, 702912, and 700986

1. Attach the connecting lead (IC clip or alligator clip) that came with the logic probe, and push the logic probe levers inwards to lock the connector into place. To remove the connecting leads from the logic probe, push both of the levers outwards. Proceed to step 3.



Connecting the Isolated Logic Probe (700987)

1. Connect the measurement leads to the logic probe's input terminal.

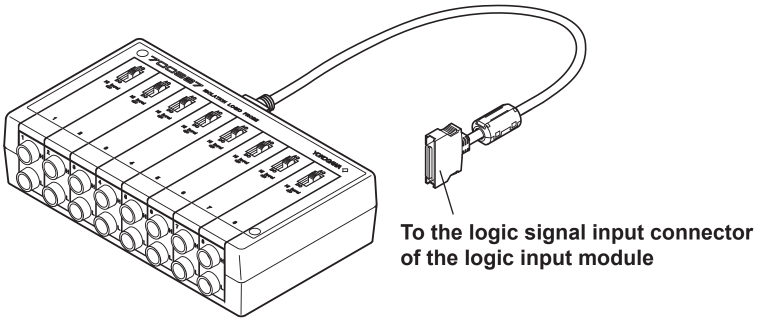
2. Set the input switch. When you set it to AC, the threshold levels are 50 VAC ± 50% (Hi: 80 to 250 VAC, Lo: 0 to 20 VAC); when you set it to DC, the threshold levels are 6 V ± 50% (Hi: 10 to 250 VDC, Lo: 0 to 3 VDC).

Connecting the Logic Probe to a Logic Input Module

3. Turn the instrument's power switch off.

4. Connect to the logic signal input connector of the logic input module (720230) the end of the logic probe's 26-pin connector that has a clamp filter (ferrite core; part number: A1190MN).

5. Turn on the DL850E/DL850EV.


To the logic signal input connector of the logic input module

Note

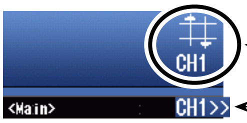
- When a logic probe is not connected to the DL850E/DL850EV, each bit is indicated as being at the high level.
- For the logic probe specifications, see section 6.14, "Logic Probe Specifications."
- The logic input display is turned off by default. For information about turning the display on and off, see chapter 1, "Vertical and Horizontal Control," in the user's manual.

3.11 Connecting an Acceleration Sensor

An acceleration sensor is connected when measuring acceleration on the 701275 (ACCL/VOLT). For a details on acceleration sensors, see the respective manuals.

WARNING

Over-Range Indication
If over-range is indicated, the DL850E/DL850EV may be receiving a voltage higher than the observed waveform or measured waveform values. To prevent electric shock, change the vertical scale with the SCALE knob so that the entire amplitude of the waveform is displayed within the waveform display area, and check the input voltage level.



Over-range indication
Indicates the number of the channel that over-range is occurring on.

Channel indication when over-range is occurring on multiple channels
Indicates the smallest number among the channels that over-range is occurring on.

CAUTION

- Applying a voltage that exceeds the values indicated below to the 701275 (ACCL/VOLT) may damage the input section.
  Maximum input voltage: 42 V (DC + ACpeak)
- When connecting acceleration sensors, do it without the bias current being supplied to the sensor. Otherwise, damage to the internal circuitry of the acceleration sensors may result.
- The DL850E/DL850EV only supports acceleration sensors that are driven by constant current with driving current of 4 mA and driving voltage of 22 V.

Connecting Acceleration Sensors

When Connecting Built-in Amplifier Type Acceleration Sensors

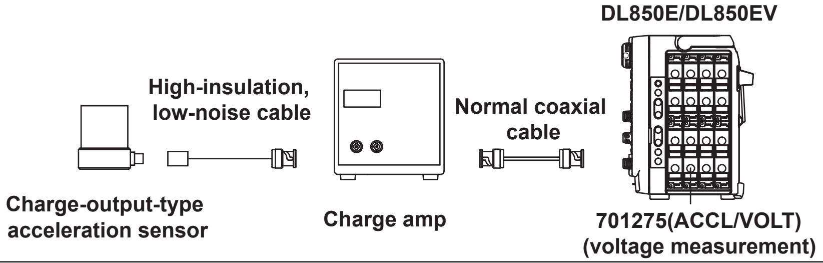
The DL850E/DL850EV allows built-in amplifier type (low impedance) acceleration sensors to be directly connected. To connect built-in amplifier type acceleration sensors, use BNC cables. Use cables that are appropriate for the acceleration sensors being used.
Connect the acceleration sensors with the bias current turned off. After connection, turn on the supply current to the acceleration sensors for making measurements.

When Connecting Charge Output Type Acceleration Sensors

Since the charge output type (high impedance) acceleration sensors do not have built-in amplifier circuit, they cannot be directly connected to the DL850E/DL850EV. Use either of the following two methods to connect the sensors.

Using the Charge Amplifier

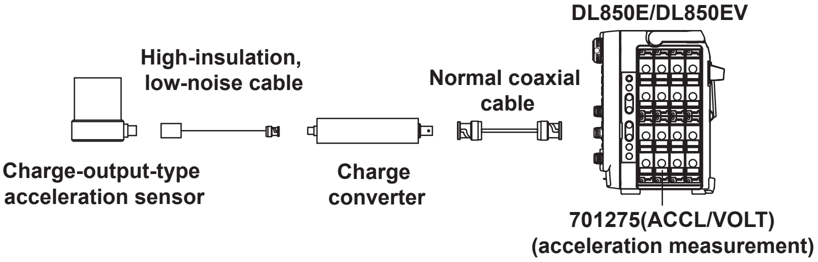
Connect a charge-output-type acceleration sensor to the charge amplifier using a high-insulation, low-noise cable. The acceleration signal (charge signal) that has been converted to a voltage signal by the charge amplifier is input to the DL850E/DL850EV using a normal coaxial cable. The DL850E/DL850EV measures the signal in the voltage measurement mode. The measured data can be converted to acceleration values using the scale conversion function of the DL850E/DL850EV.


DL850E/DL850EV
High-insulation, low-noise cable
Normal coaxial cable
Charge-output-type acceleration sensor
Charge amp
701275(ACCL/VOLT) (voltage measurement)

When using the charge converter

Connect a charge-output-type acceleration sensor to the charge converter using a high-insulation, low-noise cable. By driving the charge converter using a constant current from the DL850E/DL850EV, voltage signals similar to those of the built-in amplifier type acceleration sensor can be obtained. The DL850E/DL850EV measures the signals in the acceleration measurement mode and supplies bias current to the charge converter. Set the input sensitivity of the DL850E/DL850EV according to the charge converter gain and the sensitivity of the charge output type acceleration sensor.

The DL850E/DL850EV only supports charge converters that are driven by constant current with driving current of 4 mA and driving voltage of 22 V.


DL850E/DL850EV
High-insulation, low-noise cable
Normal coaxial cable
Charge-output-type acceleration sensor
Charge converter
701275(ACCL/VOLT) (acceleration measurement)

Note

The unit of measuʳement of acceleration on the DL850E/DL850EV is m/s^2. If the sensitivity is indicated in mV/G for the acceleration sensor that you are using, convert it to m/s^2. (1 G = 9.81 m/s^2)

Precautions

- Do not apply shock outside the specifications (see the manual for the acceleration sensor) to the acceleration sensors. Doing so can damage the sensors.
- Do not impose drastic temperature changes on the acceleration sensors. Temperature changes may affect the output value of the acceleration sensors.
- By default, the bias current on the acceleration sensors is turned off. Be sure to turn it on before using the acceleration sensors. Bias current is valid only when measuring acceleration. When measuring other parameters, it is automatically turned off. The bias current on/off setting is saved when the DL850E/DL850EV is turned off.

3.12 Connecting Sensors to the Frequency Module

Sensors and Signal Output Sources That Can Be Connected

The table below shows the sensor and signal output source that can be connected. Appropriate input presets are provided for each sensor and signal output source. For information about presets, see Input Setup in section 1.7, “Configuring Frequency, Revolution, Period, Duty Cycle, Power Supply Frequency, Pulse Width, Pulse Integration, and Velocity Measurements,” in the user’s manual.

Sensor and Signal Output Source	Preset Name
5-V logic signal, 5-V output sensor, and sensor with TTL output	Logic 5V
3-V logic signal and 3-V output sensor	Logic 3V
12-V driven relay/sequence circuit and 12-V driven sensor	Logic 12V
24-V driven relay/sequence circuit and 24-V driven sensor	Logic 24V
Sensor/Encoder that outputs positive and negative voltages and sensor that outputs sine waves	ZeroCross
100-VAC power supply (connected via the isolated probe (700929))	AC100V
200-VAC power supply (connected via the isolated probe (700929))	AC200V
Power-generating electromagnetic pickup	EM Pickup
Open collector (0 to 5 V) output sensor, contact output	Pull-up 5V*

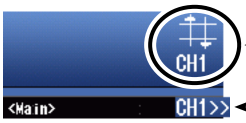
* For the internal equivalent circuit when the preset setting is Pull-up 5V, see the “Frequency Measurement” section in chapter 2, “Vertical Axis” in the feature’s guide (IM DL850E-01EN).

Precautions to Be Taken When Connecting to Sensors or Signal Output Sources

WARNING

Over-Range Indication

If over-range is indicated, the DL850E/DL850EV may be receiving a voltage higher than the observed waveform or measured waveform values. To prevent electric shock, change the vertical scale with the SCALE knob so that the entire amplitude of the waveform is displayed within the waveform display area, and check the input voltage level.



Over-range indication
Indicates the number of the channel that over-range is occurring on.

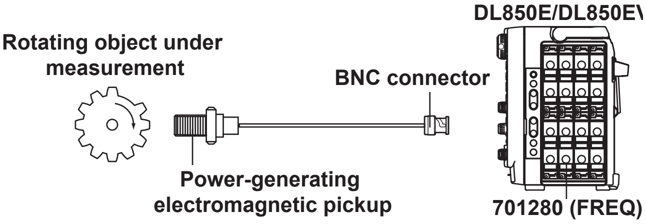
Channel indication when over-range is occurring on multiple channels
Indicates the smallest number among the channels that over-range is occurring on.

CAUTION

- The maximum input voltage for direct input is indicated below. Applying a voltage exceeding this value can damage the input section. When applying a high voltage of 42 V or more, be sure to use an isolated probe (the 700929 or 701947).
  Maximum input voltage: 42 V (DC + ACpeak) (CAT II)
- The minimum input voltage is 0.2 Vpp. At voltage amplitude less than 0.2 Vpp, the measured values may be unstable.
- Attach/Remove the sensors after confirming that the rotating object to be measured is stopped.
- Set the preset to electromagnetic pickup (EM Pickup) only when using the electromagnetic pickup.

Connecting the Electromagnetic Pickup

- The DL850E/DL850EV allows power-generating electromagnetic pickup to be connected directly. The DL850E/DL850EV does not support electromagnetic pickups that require external power supply or those that require a terminator at the output.
- To connect electromagnetic pickups, use BNC cables. Use cables that are appropriate for the electromagnetic pickups being used.
- When the input is set to electromagnetic pickup, determination is not made on whether the input voltage level exceeds the specified input voltage range. Therefore, the LEDs (see page 3-8) do not illuminate eve when the input voltage level is over range.


DL850E/DL850EV
Rotating object under measurement
BNC connector
Power-generating electromagnetic pickup
701280 (FREQ)

3.13 Connecting Wires to the 16-CH Voltage Input Module

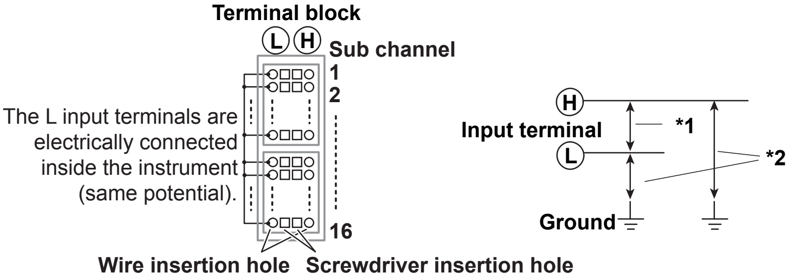
To measure voltages with the 720220 (16CH VOLT), connect wires to the terminal block.

WARNING

- When connecting a device under measurement to the instrument, be sure to turn off the device. It is extremely dangerous to connect or remove wires while the device under measurement is on.

Precautions to Be Taken When Using the Modules

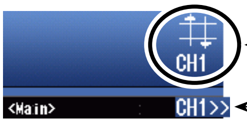
- Do not apply input voltage exceeding the maximum input voltage, withstand voltage, or allowable surge voltage.
- To avoid electric shock, be sure to ground the instrument.
- To prevent the possibility of electric shock, be sure to fasten the module screws. Otherwise, the electrical protection function and the mechanical protection function will not be activated.
- Do not leave the instrument connected to devices in an environment that may be subject to voltage surges.
- To prevent electric shock, connect wires to the terminal block that match the voltage range that you are measuring.
- Applying a voltage exceeding the value indicated below may damage the input section. If the frequency is above 1 kHz, damage may occur even when the voltage is below this value.
  Maximum input voltage (across the input terminals, H and L,[1] at a frequency of 1 kHz or less)
  42 V (DC + ACpeak)
  Maximum allowable common mode voltage (across the input terminals, H or L, and earth,[2] at a frequency of 1 kHz or less)
  42 V (DC + ACpeak) (CAT II, 30 Vrms)
- Wire the L input terminals for all of the sub channels on the same module to the same potential. The L input terminals of the sub channels are all common. Because the L input terminals are electrically connected inside the DL850E/DL850EV, connecting different potentials to them could result in short circuiting and damage to the 16-CH voltage input module.


Terminal block
L
H
Sub channel
1
2
16
The L input terminals are electrically connected inside the instrument (same potential).
Input terminal
H
L
*1
*2
Ground
Wire insertion hole
Screwdriver insertion hole

- When you release or lock the terminal block release levers, be careful not to injure yourself on the levers' protrusions.

Over-Range Indication

If over-range is indicated, the DL850E/DL850EV may be receiving a voltage higher than the observed waveform or measured waveform values. To prevent electric shock, change the vertical scale with the SCALE knob so that the entire amplitude of the waveform is displayed within the waveform display area, and check the input voltage level.



Over-range indication
Indicates the number of the channel that over-range is occurring on.

Channel indication when over-range is occurring on multiple channels
Indicates the smallest number among the channels that over-range is occurring on.

CAUTION

When you attach the terminal block, if you try to attach it upside down, you may damage the terminal block and the module. Check the vertical orientation of the block before you install it.

What to Prepare

Wiring

Remove approximately 7 mm of the insulation from the ends of the wires.

Electrical wire: 0.20 mm^2 to 1.00 mm^2 recommended (solid wire or thin stranded wire). AWG size: 24-18.

Flat-blade Screwdriver

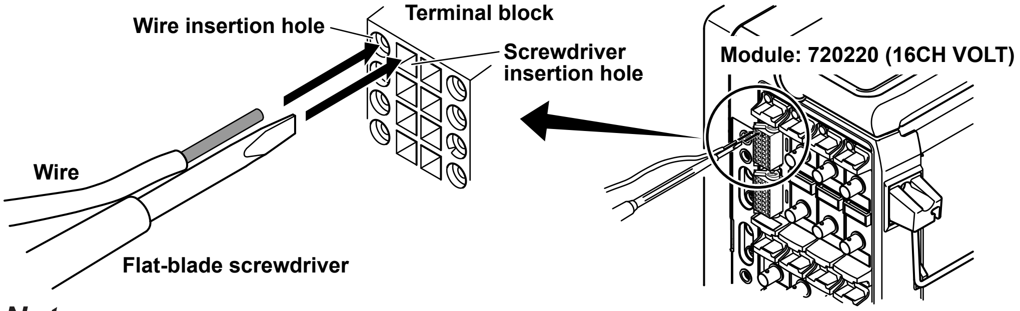
Tip size:	0.4 mm (thickness) × 2.5 mm (width)
Shape:	DIN5264-A (Use a straight driver.)

Connecting Wires to the Terminal Block

First, turn off the DL850E/DL850EV. Make sure that the other end of the wire that you are connecting to the terminal block is not connected to the device under measurement, or make sure that the device under measurement that you are going to connect to is turned off.

1. Insert the flat-blade screwdriver into the screwdriver insertion hole right next to the wire insertion hole.
   If you do not insert the flat-blade screwdriver into the hole firmly, the wire insertion hole will not open.
2. Insert the wire that you prepared into the wire insertion hole.
   Insert the wire until it reaches the back of the wire insertion hole.
3. Pull the flat-blade screwdriver out of the screwdriver insertion hole.
   When you pull out the flat-blade screwdriver, hold the wire in place so that it does not come out with the screwdriver.
4. Pull lightly on the wire to make sure that it doesn't come out.

After you have finished connecting the wires, turn on the DL850E/DL850EV and the device under measurement.



Note

Removing and Attaching the Terminal Block

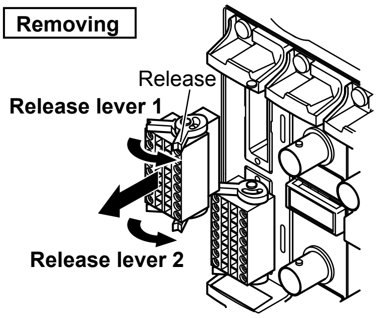
It is normally not necessary to remove the terminal block, but it is possible to do so.

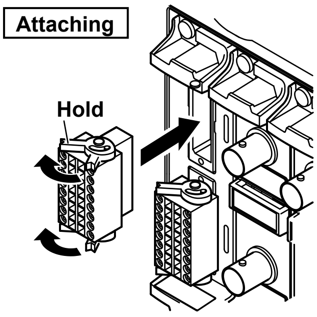
Removal

Push terminal block release levers 1 and 2 to their release positions, and pull out the terminal block.

Attachment

Push terminal block release levers 1 and 2 to their lock positions, and insert the terminal block. Push the terminal block firmly all the way to the back. However, the terminal block will not go all the way to the back if it is upside down. Do not try to force the terminal block all the way to the back.





3.14 Connecting Wires to the 16-CH Temperature/ Voltage Input Module

If you are using a 720221 (16CH TEMP/VOLT) to measure temperature and voltage, connect thermocouples or wires to the 16-channel scanner box.

WARNING

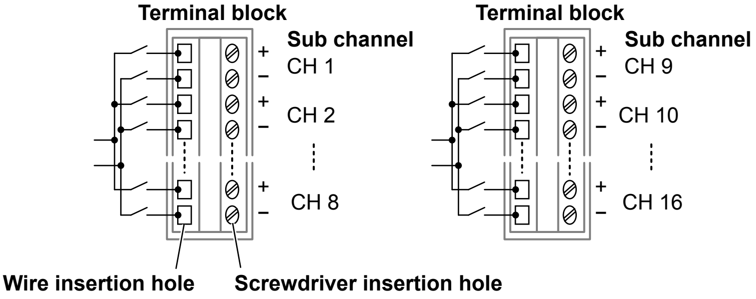
- When connecting a device under measurement to the instrument, be sure to turn off the device. It is extremely dangerous to connect or disconnect thermocouples or wires while the device under measurement is on.

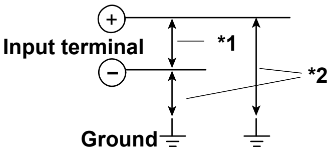
Precautions to Be Taken When Using the Modules

- To avoid electric shock, be sure to ground the instrument.
- To prevent the possibility of electric shock, be sure to fasten the module screws. Otherwise, the electrical protection function and the mechanical protection function will not be activated.

Precautions to Be Taken When Using the 16-CH Scanner Box

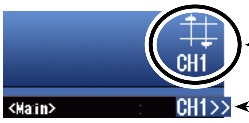
- Do not connect or disconnect the 16-CH scanner box or the cables that are connected to it while the power is on.
- Do not apply input voltage exceeding the maximum input voltage, withstand voltage, or allowable surge voltage.
- Do not leave the instrument connected to devices in an environment that may be subject to voltage surges.
- To prevent electric shock, connect wires to the terminal block that match the voltage range that you are measuring.
- Applying a voltage exceeding the value indicated below may damage the input section. If the frequency is above 1 kHz, damage may occur even when the voltage is below this value.
  Maximum input voltage (across the input terminals, + and −,[1] at a frequency of 1 kHz or less)
  42 V (DC + ACpeak)
  Maximum allowable common mode voltage (across the input terminals, + or −, and earth,[2] at a frequency of 1 kHz or less)
  42 V (DC + ACpeak) (CAT II, 30 Vrms)
- The − input terminals of the sub channels are electrically insulated inside the scanner box. If you connect a wire that has a potential difference greater than 42 V (DC + ACpeak) between sub channels, the insulation may be damaged, which will lead to the 16-CH scanner box being damaged.





Over-Range Indication

If over-range is indicated, the DL850E/DL850EV may be receiving a voltage higher than the observed waveform or measured waveform values. To prevent electric shock, change the vertical scale with the SCALE knob so that the entire amplitude of the waveform is displayed within the waveform display area, and check the input voltage level.



Over-range indication
Indicates the number of the channel that over-range is occurring on.

Channel indication when over-range is occurring on multiple channels
Indicates the smallest number among the channels that over-range is occurring on.

CAUTION

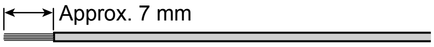
- Correct measurements cannot be obtained when the positive and negative thermocouple leads are connected in reverse.
- Immediately after connecting the thermocouple, the heat balance may be disturbed at the input terminal section and may cause measurement errors. Therefore, wait about ten minutes before making a measurement.
- In an environment where the air from the air conditioning is directly applied to the input terminals or where there are effects from a heat source, the heat balance may be disturbed at the input terminal section and cause measurement errors.
  When making measurements in this type of environment, take preventive measures such as changing the position.

What to Prepare

Thermocouple or Wiring

Remove approximately 7 mm of the insulation from the ends of the thermocouple or wires.

Electrical wire: 0.14 mm^2 to 1.5 mm^2 recommended (solid wire or thin stranded wire). AWG size: 26-16.



Flat-blade Screwdriver

Tip size: 0.6 mm (thickness) × 3.5 mm (width)

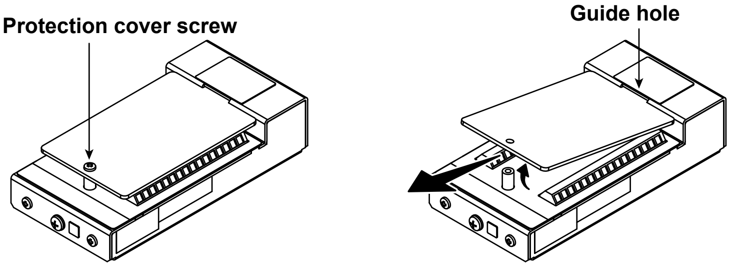
Screw tightening torque: 0.5 to 0.6 N•m)

Connecting Wires to the Terminal Block

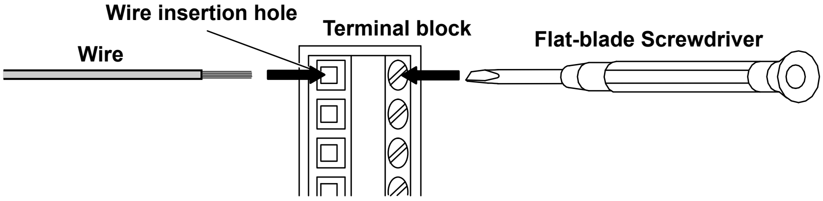
First, turn off the DL850E/DL850EV. Make sure that the other end of the wire that you are connecting to the terminal block is not connected to the device under measurement, or make sure that the device under measurement that you are going to connect to is turned off.

When you first use the 16-CH scanner box, follow the procedure from step 3.

1. Remove the protection cover screw using a screwdriver.
2. Pull the protection cover up, and pull it out from the guide hole.



3. Loosen the terminal block screw using a flat-blade screwdriver.
4. Insert the thermocouple or wire that you prepared into the wire insertion hole.
   Insert the thermocouple or wire until its end reaches the back of the wire insertion hole.
5. Tighten the terminal block screw using a flat-blade screwdriver.



6. Pull lightly on the wire to make sure that it doesn't come out.

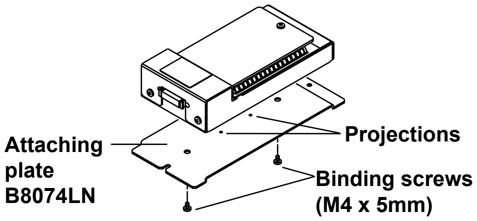
7. Insert the protection cover into the guide hole.
8. Tighten the protection cover screw using a screwdriver.

Fixing the Device in Place

If necessary, you can use the accessory attaching plate, B8074LN, to fix the scanner box to the panel.

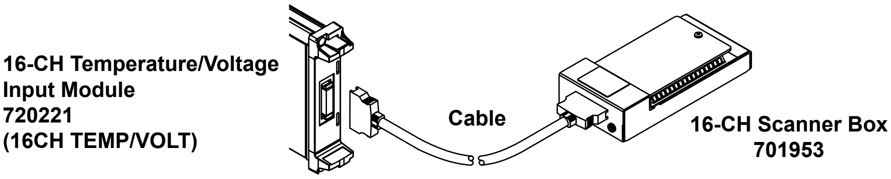
1. Align the small holes on the bottom side of the scanner box to the small projections of the attaching plate.
2. Screw the scanner box and the attaching plate together using the accessory binding screws (M4 × 5 mm).

   Screw tightening torque: 1.2 N•m


Attaching plate B8074LN
Projections
Binding screws (M4 x 5mm)

Connecting the 16-CH Temperature/Voltage Input Module and the Scanner Box

Using the cable that came with the scanner box (701953), connect the 720221 (16CH TEMP/VOLT) and the scanner box.


16-CH Temperature/Voltage Input Module 720221 (16CH TEMP/VOLT)
Cable
16-CH Scanner Box 701953

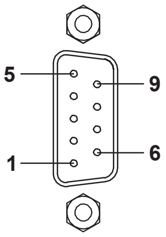
3.15 Connecting a Cable to the CAN Bus Monitor Module

To monitor CAN bus signals, connect a cable to the CAN bus monitor module’s D-sub connector.

Connector Pinout

The pinout of the D-sub connector (9 pin, male) is shown below.

Pinout



Pin No.	Signal	Function
1	(NC)	Not used (can not be connected to)
2	CAN_L	CAN low signal
3	GND	Ground
4	(NC)	Not used (can not be connected to)
5	(NC)	Not used (can not be connected to)
6	GND	Ground
7	CAN_H	CAN high signal
8	(NC)	Not used (can not be connected to)
9	(NC)	Not used (can not be connected to)

* One-inch screws (number 4-40 UNC) are used.

Note

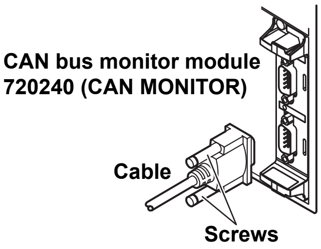
The connector shell is connected to GND. Additionally, GND and the connector shell are isolated from the electric potential of the DL850E/DL850EV case (earth).

⚠ **CAUTION**

Applying a voltage greater than the maximum input voltage may damage the input section.

Connecting the Cable (Signal wires)

When you connect a cable to the D-sub connector, be sure to tighten the screws to ensure that the cable is connected securely.

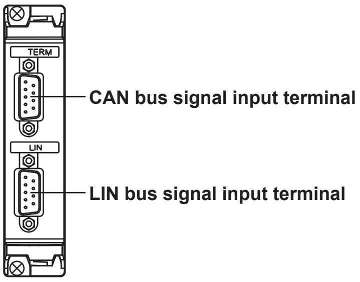


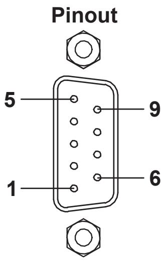
3.16 Connecting a Cable to the CAN & LIN Bus Monitor Module

To monitor CAN bus signals, connect a cable to the CAN bus monitor module's D-sub connector.

Connector Pinout

The pinout of the D-sub connector (9 pin, male) is shown below.





	CAN bus signal input terminal		LIN bus signal input terminal	
Pin No.	**Signal**	**Function**	**Signal**	**Function**
1	(NC)	Not used (can not be connected to)	LIN	LIN signal
2	CAN_L	CAN low signal	(NC)	Not used (can not be connected to)
3	CAN_GND	Ground	LIN_GND	Ground
4	(NC)	Not used (can not be connected to)	VBAT	Battery supply voltage
5	(NC)	Not used (can not be connected to)	(NC)	Not used (can not be connected to)
6	CAN_GND	Ground	LIN_GND	Ground
7	CAN_H	CAN high signal	(NC)	Not used (can not be connected to)
8	(NC)	Not used (can not be connected to)	(NC)	Not used (can not be connected to)
9	(NC)	Not used (can not be connected to)	(NC)	Not used (can not be connected to)

* One-inch screws (number 4-40 UNC) are used.

Note

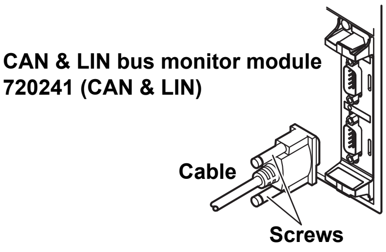
The shell of the CAN bus signal input connector is connected to CAN_GND. The shell of the LIN bus signal input connector is connected to LIN_GND. Additionally, CAN_GND and its connector shell and LIN_GND and its connector shell are isolated from the electric potential of the DL850E/DL850EV case (earth).

CAUTION

Applying a voltage greater than the maximum input voltage may damage the input section.

Connecting the Cable (Signal wires)

When you connect a cable to the D-sub connector, be sure to tighten the screws to ensure that the cable is connected securely.

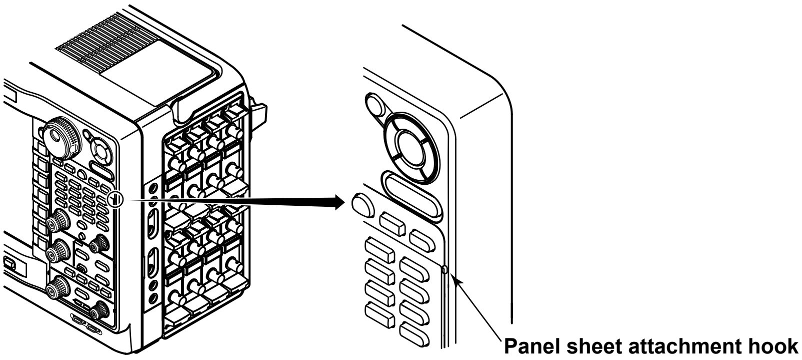


3.17 Attaching the Panel Sheet

Depending on the suffix code, attach the supplied front panel sheet if necessary. You can attach the panel sheet over the panel sheet that was attached when the DL850E/DL850EV was shipped from the factory.

Attaching the Panel Sheet

There are three panel sheet attachment hooks on both the left and right sides of the front panel.
Hook the panel sheet onto the three hooks on the left side.
Then, bend the panel sheet slightly, and hook it onto the three hooks on the right side.



3.18 Loading Roll Paper into the Built-In Printer (Optional)

This section explains how to load roll paper into the optional built-in printer.

Printer Roll Paper

Only use roll paper specifically made for use with the DL850E/DL850EV series. The DL850E/DL850EV comes with one set of roll paper included. Use this when you first load roll paper into the built-in printer. When you need a new supply of roll paper, please contact your nearest YOKOGAWA dealer.

Part Number:	B9988AE
Specifications:	Heat sensitive paper, 10 m
Minimum Quantity:	10 rolls

Handling Roll Paper

The roll paper is made of heat sensitive paper that changes color thermochemically. Please read the following information carefully.

Storage Precautions

The heat-sensitive paper changes color gradually at temperatures of approximately 70°C or higher. The paper can be affected by heat, humidity, light, and chemicals, whether something has been recorded on it. As such, please follow the guidelines listed below.

- Store the paper in a cool, dry, and dark place.
- Use the paper as quickly as possible after you break its protective seal.
- If you attach a plastic film that contains plasticizing material, such as vinyl chloride film or cellophane tape, to the paper for a long time, the recorded sections will fade due to the effect of the plasticizing material. Use a holder made of polypropylene to store the roll paper.
- When pasting the record paper to another material, do not use paste that contains organic solvents such as alcohol or ether. Doing so will change the paper’s color.
- We recommend that you make copies of the recordings if you intend to store them for a long period of time. Because of the nature of heat-sensitive paper, the recorded sections may fade.

Handling Precautions

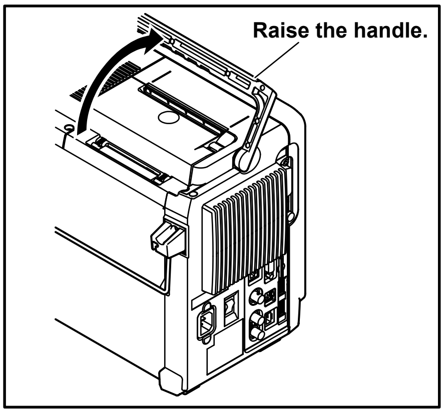
- Only use genuine, YOKOGAWA-supplied roll paper.
- If you touch the roll paper with sweaty hands, there is a chance that you will leave fingerprints on the paper, or blur the recorded sections.
- If you rub something hard against the surface of the roll paper, the paper may change color due to frictional heat.
- If the roll paper comes into contact with products such as chemicals or oil, the paper may change color or the recorded sections may disappear.

Attaching the Roll Paper

CAUTION

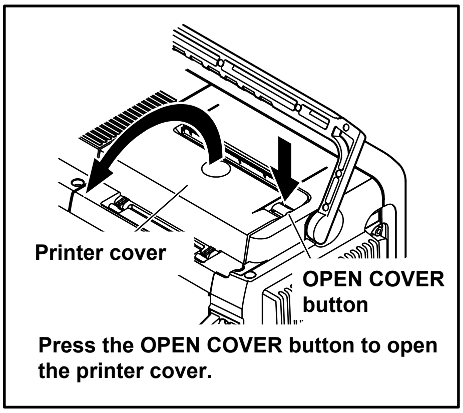
- Do not touch the print head. If you do, you may burn yourself.
- Do not touch the roll paper cutter section at the front end of the printer cover. Doing so may cause injury.

1.



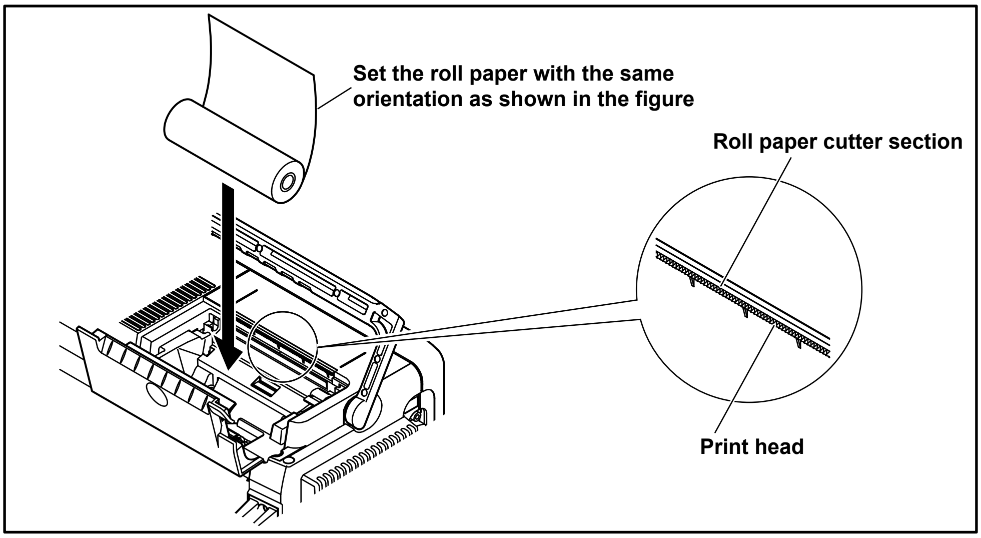
Raise the handle.

2.


Printer cover
OPEN COVER button

Press the OPEN COVER button to open the printer cover.

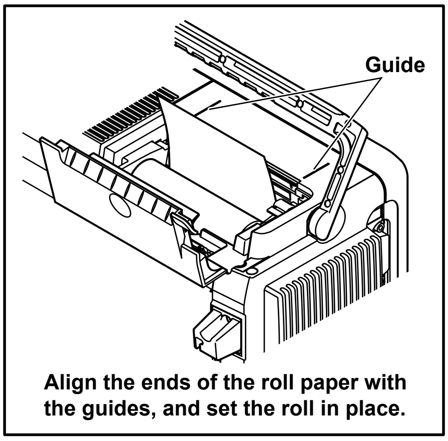
3.



Set the roll paper with the same orientation as shown in the figure

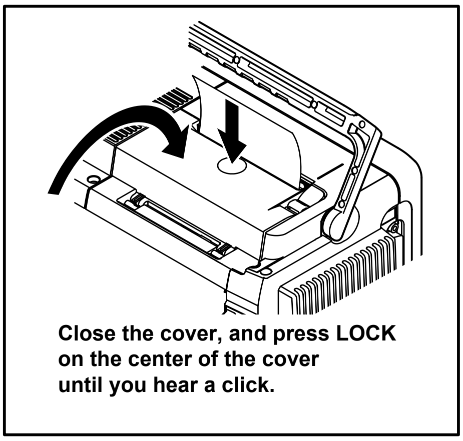
Roll paper cutter section
Print head

4.



Align the ends of the roll paper with the guides, and set the roll in place.

5.

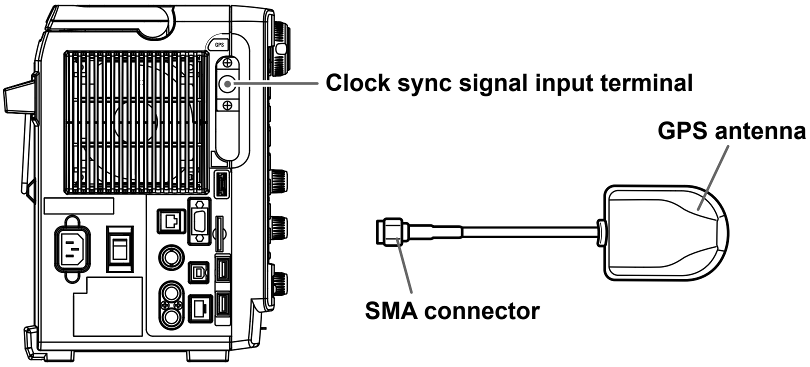


Close the cover, and press LOCK on the center of the cover until you hear a click.

3.19 Connecting an Antenna to the GPS Interface (Option)

To synchronize the clock using GPS, connect the supplied GPS antenna to the clock sync signal input terminal

DL850E/DL850EV


GPS
Clock sync signal input terminal
GPS antenna
SMA connector

CAUTION

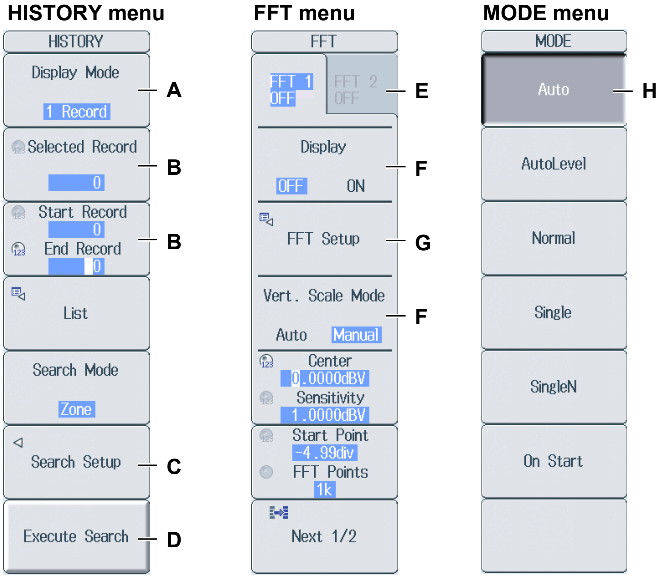
- Attach or remove the GPS antenna from the DL850E/DL850EV with the power turned off.
- If installed indoors, place the GPS antenna near a window or a location where it has a good line of sight to GPS satellites.
  Otherwise, time synchronization may not work properly.
- Do not install the GPS antenna in water or in contact with other liquids.

4.1 Key and Jog Shuttle Operations

Key Operations

How to Use Setup Menus That Appear When Keys Are Pressed

The operation after you press a key varies depending on the key that you press.


HISTORY menu
FFT menu
MODE menu
HISTORY
Display Mode
1 Record
Selected Record
0
Start Record
0
End Record
0
List
Search Mode
Zone
Search Setup
Execute Search
FFT
FFT 1 OFF
FFT 2 OFF
Display
OFF ON
FFT Setup
Vert. Scale Mode
Auto Manual
Center
0.0000dBV
Sensitivity
1.0000dBV
Start Point
-4.99div
FFT Points
1k
Next 1/2
MODE
Auto
AutoLevel
Normal
Single
SingleN
On Start
A
B
B
C
D
E
F
G
F
H

A: Press the soft key to display a selection menu.
Press the soft key that corresponds to the appropriate setting.
B: Press the soft key to use the jog shuttle to configure this setting. Use the jog shuttle or the arrow keys to set the value or select an item.
To set a value, press NUM LOCK, and then use the CH1 to CH16 keys.
C: A related setup menu appears when you press the soft key.
D: Press the soft key to execute the specified feature.
E: Selects which item to configure when configuring a feature that consists of two items that operate with different settings, such as the FFT1 and FFT2 features.
F: The selected setting switches each time you press the soft key.
G: Displays a dialog box or a keyboard.
Use the jog shuttle, SET key, and arrow keys to configure the settings in the dialog box or operate the keyboard.
H: Pressing a key sets the item to the setting that corresponds to that key.

How to Display the Setup Menus That Are Written in Purple below the Keys

In the explanations in this manual, “SHIFT+key name (written in purple)” is used to indicate the following operation.

1. Press **SHIFT**. The SHIFT key illuminates to indicate that the keys are shifted.

   Now you can select the setup menus written in purple below the keys.

2. Press the key that you want to display the setup menu of.

ESC Key Operation

If you press the ESC key when a setup menu or available settings are displayed, the screen returns to the menu level above the current one. If you press the ESC key when the highest level menu is displayed, the setup menu disappears.

RESET Key Operation

If you press RESET when you are using the jog shuttle to set a value or select an item, the setting is reset to its default value (depending on the operating state of the DL850E/DL850EV, the setting may not be reset).

SET Key Operations

The operation varies as indicated below depending on what you are setting.

- For a setup menu that has two values that you use the jog shuttle to adjust
  Press SET to switch the value that the jog shuttle adjusts.
- For a menu that has the jog shuttle + SET mark (◯+SET) displayed on it.
  Press SET to confirm the selected item.

Arrow Key Operations

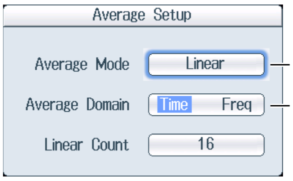
The operation varies depending on what you are setting.

- When setting a value
  Up and down arrow keys: Increases and decreases the value
  Left and right arrow keys: Changes which digit to set
- When selecting the item to set
  You can use the up and down arrow keys.

How to Enter Values in Setup Dialog Boxes

1. Use the keys to display the appropriate setup dialog box.
2. Use the jog shuttle or the arrow keys to move the cursor to the setting that you want to set.
3. Press **SET**. The operation varies as indicated below depending on what you are setting.
   - A selection menu appears.
   - A check box is selected or cleared.
   - An item is selected.
   - A table of settings is selected.

Displaying a Selection Menu and Selecting an Item


Average Setup

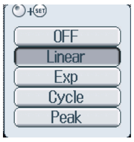
Average Mode: Linear

Average Domain: Time Freq

Linear Count: 16

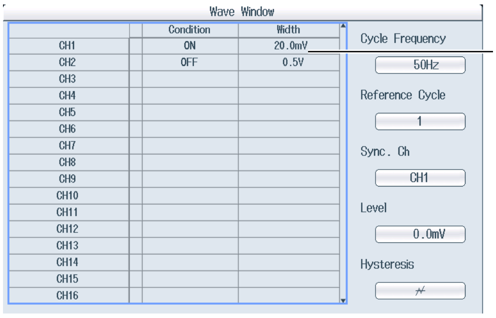
Displays the selection menu

Select Time or Freq.



After selecting an item with the jog shuttle, press SET to confirm it.

Setting Items in a Table


Wave Window

	Condition	Width
CH1	ON	20.0mV
CH2	OFF	0.5V
CH3		
CH4		
CH5		
CH6		
CH7		
CH8		
CH9		
CH10		
CH11		
CH12		
CH13		
CH14		
CH15		
CH16		

Cycle Frequency: 50Hz

Reference Cycle: 1

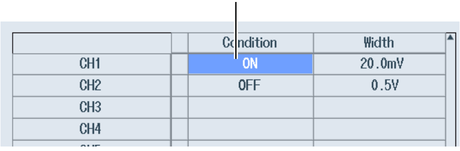
Sync. Ch: CH1

Level: 0.0mV

Hysteresis

After moving the cursor to the table, press SET to select the setting the you want to change.

Press SET to select a table entry.



	Condition	Width
CH1	ON	20.0mV
CH2	OFF	0.5V
CH3		
CH4		

How to Clear Setup Dialog Boxes

Press **ESC** to clear the setup dialog box from the screen.

4.2 Entering Values and Strings

Entering Values

Using Dedicated Knobs

You can use the following dedicated knobs to enter values directly.

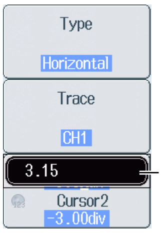
- Vertical POSITION knob
- SCALE knob
- TIME/DIV knob
- ZOOM magnification knob (MAG)
- Zoom POSITION knob (for scrolling zoom waveforms)

Using the Jog Shuttle

Select the appropriate item using the soft keys, and change the value using the jog shuttle, the SET key, and the arrow keys. This manual sometimes describes this operation simply as “using the jog shuttle.”

Using the Keypad

Press **NUM LOCK** to illuminate the NUM LOCK key, and use the **CH1** to **CH16** keys to enter a value. After you enter the value, press **ENTER** to confirm it.



Type
Horizontal

Trace
CH1

3.15

Cursor2
-3.00div

Use the keypad to enter the value.

Note

Some items that you can set using the jog shuttle are reset to their default values when you press the RESET key.

Entering Character Strings

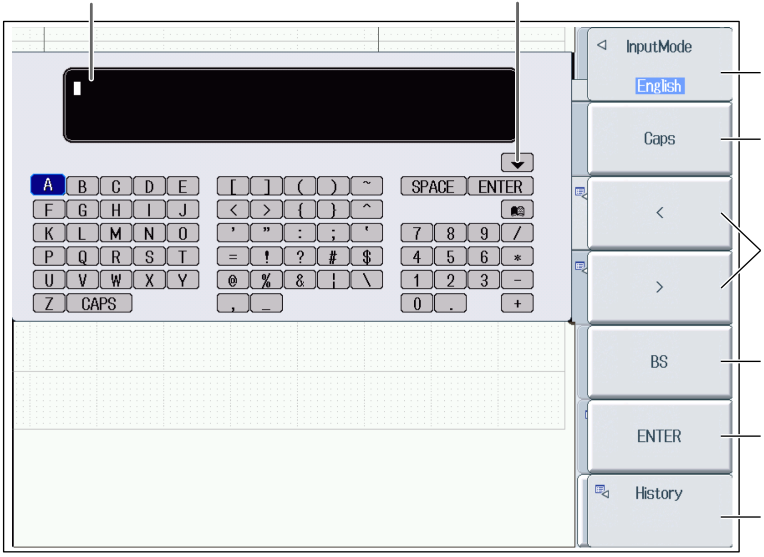
Use the keyboard that appears on the screen to enter file names and comments. Use the jog shuttle, the SET key, and the arrow keys to operate the keyboard and enter a character string.

How to Operate the Keyboard

1. Press the **InputMode** soft key and then the **English** soft key.
2. After bringing up the keyboard, use the jog shuttle to move the cursor to the character that you want to enter. You can also move the cursor using the up, down, left, and right arrow keys.
3. Press SET to enter the character.
   - If a character string has already been entered, use the arrow soft keys (< and >) to move the cursor to the position you want to insert characters into.
   - To switch between uppercase and lowercase letters, press the **Caps** soft key.
   - To delete the previous character, press the **BS** soft key.
4. Repeat steps 1 and 3 to enter all of the characters in the string.
   Select ▼ on the keyboard or press the **History** soft key to display a list of character strings that you have entered previously.
   Use the jog shuttle to select a character string, and press **SET** to enter the selected character string.
5. Press the **ENTER** soft key, or move the cursor to ENTER on the keyboard, and press **SET** to confirm the character string and clear the keyboard.

Character insertion position

Select to enter a string from the history.



Select the keyboard language (English, Japanese).

Switches between uppercase and lowercase

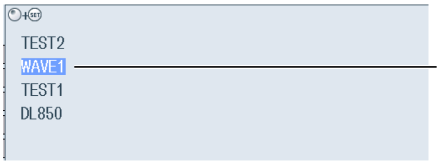
Moves the character insertion position

Deletes the previous character

Confirms the characters that you have entered

Select to enter a string from the history.

List of previously entered strings


TEST2
WAVE1
TEST1
DL850

After selecting an item using the jog shuttle or the arrow keys, press SET to confirm it.

Note

- @ cannot be entered consecutively.
- File names are not case-sensitive. Comments are case-sensitive. The following file names cannot be used due to MS-DOS limitations:
  AUX, CON, PRN, NUL, CLOCK, COM1 to COM9, and LPT1 to LPT9

4.3 Using USB Keyboards and Mouse Devices

Connecting a USB Keyboard

You can connect a USB keyboard and use it to enter file names, comments, and other items.

Usable Keyboards

You can use the following keyboards that conform to USB Human Interface Devices (HID) Class Ver. 1.1.

- When the USB keyboard language is English: 104 keyboards
- When the USB keyboard language is Japanese: 109 keyboards

Note

- Do not connect incompatible keyboards.
- The operation of USB keyboards that have USB hubs or mouse connectors is not guaranteed.
- For USB keyboards that have been tested for compatibility, contact your nearest YOKOGAWA dealer.

USB Ports for Peripherals

Connect a USB keyboard to the USB port for peripherals on the left side panel.

Connection Procedure

Connect a USB keyboard directly to the DL850E/DL850EV using a USB cable. You can connect or remove the USB cable regardless of whether the DL850E/DL850EV power switch is turned on (hot-plug support). Connect the type A connector of the USB cable to the DL850E/DL850EV, and connect the type B connector to the keyboard. When the power switch is on, the keyboard is detected and enabled approximately 6 seconds after it is connected.

Note

- Only connect a compatible USB keyboard, mouse, printer, or storage device to the USB port for peripherals.
- Do not connect multiple keyboards. You can connect one keyboard, one mouse, and one printer to the DL850E/DL850EV.
- Do not connect and disconnect multiple USB devices repetitively. Wait for at least 10 seconds after you connect or remove one USB device before you connect or remove another USB device.
- Do not remove USB cables during the time from when the DL850E/DL850EV is turned on until key operation becomes available (approximately 20 to 30 seconds).

Entering File Names, Comments, and Other Items

When a keyboard is displayed on the screen, you can enter file names, comments, and other items using the USB keyboard.

Entering Values

You can use a USB keyboard to enter the values of items with 123 marks on the menu screens by pressing CTRL+N on the USB keyboard to put the DL850E/DL850EV in the NUM LOCK state.

Using a USB Mouse

You can connect a USB mouse and use it to perform the same operations that you can perform with the DL850E/DL850EV keys. Also, by clicking a menu item, you can perform the same operation that you can perform by pressing the menu item’s soft key or selecting the menu item and pressing the SET key.

USB Ports for Peripherals

Connect a USB mouse to a USB port for peripherals on the left side panel of the DL850E/DL850EV.

Usable USB Mouse Devices

You can use mouse devices (with wheels) that are compliant with USB HID Class Version 1.1.

Note

- For USB mouse devices that have been tested for compatibility, contact your nearest YOKOGAWA dealer.
- Some settings cannot be configured by a mouse without a wheel.

Connection Procedure

To connect a USB mouse to the DL850E/DL850EV, use one of the USB ports for peripherals. You can connect or disconnect the USB mouse at any time regardless of whether the DL850E/DL850EV is on or off (hot-plugging is supported). When the power switch is on, the mouse is detected approximately 6 seconds after it is connected, and the mouse pointer (↖) appears.

Note

- Only connect a compatible USB keyboard, mouse, printer, or storage device to the USB port for peripherals.
- Even though there are two USB ports for peripherals, do not connect two mouse devices to the DL850E/DL850EV.

Operating the DL850E/DL850EV Using a USB Mouse

- **Operations That Correspond to the Front Panel Keys (Top Menu)**

Displaying the Top Menu

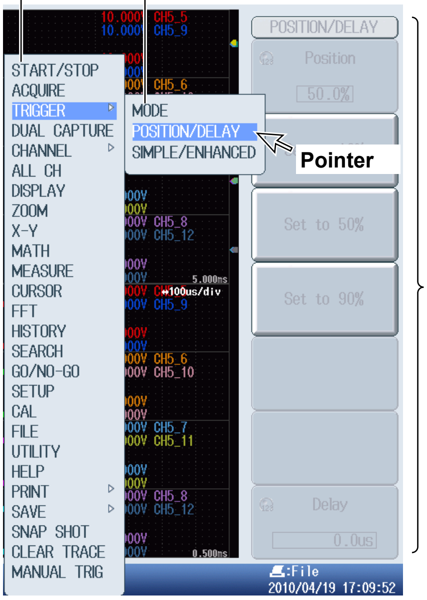
Right-click on the display. A menu of the DL850E/DL850EV front panel keys appears.

Selecting an Item from the Top Menu

Click on the item that you want to select. A setup menu that corresponds to the item that you selected appears at the bottom of the display. The top menu disappears.
To display an item's submenu, point to the item. To select an item on a submenu, click on it, just as you would to select an item on the top menu.

Top Menu
Right-click to display the top menu.

Submenu
Submenus appear for items that have them.


START/STOP
ACQUIRE
TRIGGER
DUAL CAPTURE
CHANNEL
ALL CH
DISPLAY
ZOOM
X-Y
MATH
MEASURE
CURSOR
FFT
HISTORY
SEARCH
GO/NO-GO
SETUP
CAL
FILE
UTILITY
HELP
PRINT
SAVE
SNAP SHOT
CLEAR TRACE
MANUAL TRIG
MODE
POSITION/DELAY
SIMPLE/ENHANCED
POSITION/DELAY
Position
50.0%
Set to 50%
Set to 90%
Delay
0.0us
:File
2010/04/19 17:09:52

Pointer

The setup menu that you select using the mouse appears.

Note

- The following keys are not displayed in the top menu:
  ESC, RESET, and SET

- **Setup Menu Operations (Same as soft key operations)**

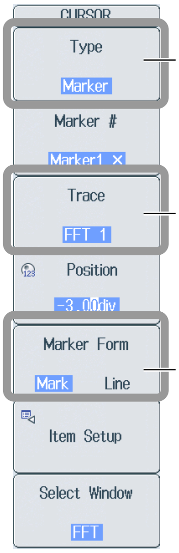
Selecting a Setup Menu Item

Click the setup menu item that you want to select.

If a selection menu appears after you select an item, click the selection menu item that you want to choose.

If an item such as ON or OFF appears, click on the item to change its setting.

For menu items that are usually selected using the job shuttle and the SET key, clicking on the item that you want to select will confirm your selection and close the dialog box.



Click in this area to display a selection menu.
Clicking the selection menu item that you want to select will confirm your selection.

Click in this area to display a menu for selecting items using the jog shuttle and SET.
Clicking the menu item that you want to select will confirm your selection.

Click in this area to change the selected item.

Clearing the Menu

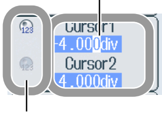
To clear the menu, click outside of it.

- **Specifying Values**

The following description explains how to specify values for menu items that have a ⟲123 icon next to them.

- If there are two ⟲123 icons next to a single menu item, click on the item to select an item to configure.
- To increase a value, rotate the mouse wheel back.
- To decrease a value, rotate the mouse wheel forward.
- To increase a value, move the pointer above the value so that the pointer becomes a ︽, and then click the left mouse button.
- To decrease a value, move the pointer below the value so that the pointer becomes a ︾, and then click the left mouse button.
- To move the decimal place, point to the left or right of the value you want to set so that the pointer becomes a ☜ or a ☞, and then click the left mouse button. The decimal place will move one place to the right or left each time you click the left mouse button.

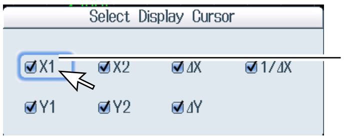
Change the value by clicking and using the mouse wheel.



Click within this area to select the item that you want to set.

- **Selecting Check Boxes**

  To select a check box, click it. To clear a check box, click it again.


Select Display Cursor
☑X1
☑X2
☑ΔX
☑1/ΔX
☑Y1
☑Y2
☑ΔY

Click the item that you want to select.

Note

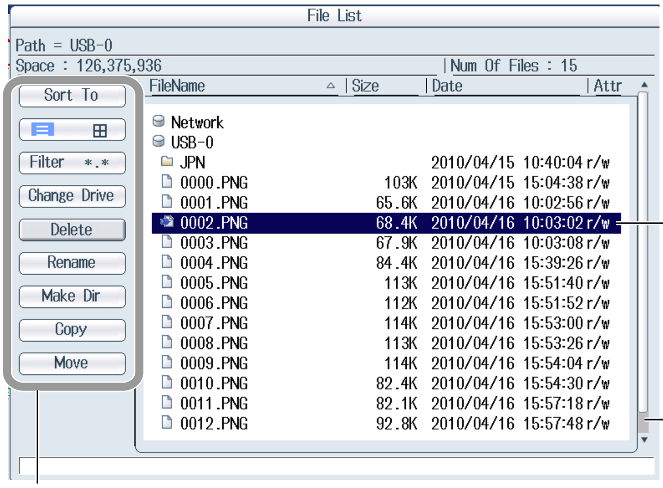
To close a dialog box, click outside of it.

- **Selecting a File, Folder, or Media Drive from the File List Window**

  Click on a file, folder, or media drive to select it.

  Rotate the mouse wheel to scroll through the file list.

  To cancel your selection, click outside of the File List window. The File List window will close when you cancel your selection.


File List
Sort To
Filter *.*
Change Drive
Delete
Rename
Make Dir
Copy
Move

Path = USB-0

Space : 126,375,936

Num Of Files : 15

FileName	Size	Date	Attr
Network			
USB-0			
JPN		2010/04/15 10:40:04	r/w
0000.PNG	103K	2010/04/15 15:04:38	r/w
0001.PNG	65.6K	2010/04/16 10:02:56	r/w
0002.PNG	68.4K	2010/04/16 10:03:02	r/w
0003.PNG	67.9K	2010/04/16 10:03:08	r/w
0004.PNG	84.4K	2010/04/16 15:39:26	r/w
0005.PNG	113K	2010/04/16 15:51:40	r/w
0006.PNG	112K	2010/04/16 15:51:52	r/w
0007.PNG	114K	2010/04/16 15:53:00	r/w
0008.PNG	113K	2010/04/16 15:53:26	r/w
0009.PNG	114K	2010/04/16 15:54:04	r/w
0010.PNG	82.4K	2010/04/16 15:54:30	r/w
0011.PNG	82.1K	2010/04/16 15:57:18	r/w
0012.PNG	92.8K	2010/04/16 15:57:48	r/w

Click on the file, folder, or media drive that you want to select.

Scroll bar

Click on the item that you want to select.

- **Setting V/DIV and TIME/DIV**

Setting V/DIV

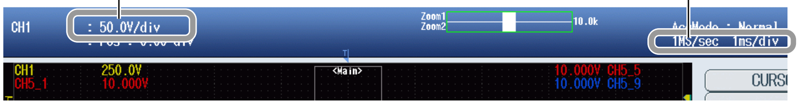
Move the pointer close to the V/DIV value in the upper left of the display. The pointer becomes a . Rotate the mouse wheel forward to increase the V/DIV value, and rotate it back to decrease the value.

Setting TIME/DIV

Move the pointer close to the TIME/DIV value in the upper right of the display. The pointer becomes a . Rotate the mouse wheel forward to increase the TIME/DIV value, and rotate it back to decrease the value.

V/DIV setting

TIME/DIV setting

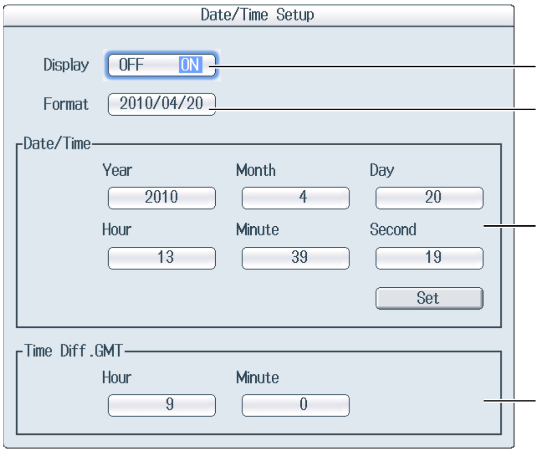

CH1
: 50.0V/div
Zoom1
Zoom2
10.0k
1MS/sec 1ms/div
CH1 250.0V
CH5_1 10.000V
<Main>
10.000V CH5_5
10.000V CH5_9
CURS

4.4 Synchronizing the Clock

This section explains how to set the DL850E/DL850EV clock, which is used to generate timestamps for measured data and files. The DL850E/DL850EV is factory shipped with a set date and time. You must set the clock before you start measurements.

UTILITY System Config Menu

Press **UTILITY**, the **System Config** soft key, and then the **Date/Time** soft key to display the following screen.



Date/Time Setup

Display: OFF ON (ON)

Format: 2010/04/20

Date/Time

Year: 2010 Month: 4 Day: 20

Hour: 13 Minute: 39 Second: 19

Time Diff.GMT

Hour: 9 Minute: 0

Turns the display of the date and time on and off

Set the display format.

Set the date and time.

Set the time difference from Greenwich Mean Time.

Setting the Display Format (Format)

You can display the date in one of the following formats.

2008/09/30 (year/numeric month/day)
30/09/2008 (day/numeric month/year)
30-Sep-08 (day-English abbreviation of the month-last two digits of the year)
30 Sep 2008 (day month (English abbreviation) year)

Setting the Time Difference from Greenwich Mean Time (Time Diff. GMT)

Set the time difference between the region where you are using the DL850E/DL850EV and Greenwich Mean Time.

Selectable range: -12 hours 00 minutes to 13 hours 00 minutes

For example, Japan standard time is ahead of GMT by 9 hours. In this case, set Time Hour to 9 and Minute to 00.

Checking the Standard Time

Using one of the methods below, check the standard time of the region where you are using the DL850E/DL850EV.

- Check the Date, Time, Language, Regional Options on your PC.
- Check the standard time at the following URL:http://www.worldtimeserver.com/

Note

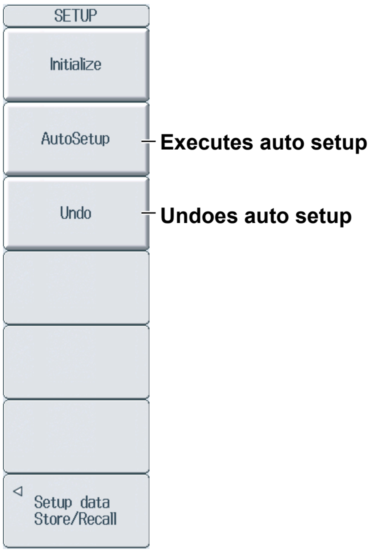
- The DL850E/DL850EV does not support Daylight Saving Time. To set the time to Daylight Saving Time, reset the time difference from Greenwich Mean Time.
- Date and time settings are backed up using an internal lithium battery. They are retained even if the power is turned off.
- The DL850E/DL850EV has leap-year information.

4.5 Performing Auto Setup

The auto setup feature automatically sets the V/div, Time/div, trigger level, and other settings to the most suitable values for the input signals.

SETUP Menu

Press **SETUP** to display the following menu.



Center Position after the Execution of Auto Setup

The center position after you execute auto setup will be 0 V.

Applicable Modules

Auto setup is performed on the following modules.

701250(HS10M12), 701251(HS1M16), 701255(NONISO_10M12), 701267(HV(with RMS)), 701261(UNIVERSAL), 701262(UNIVERSAL(AAF)), 701275(ACCL/VOLT), 720210(HS100M12), 720220(16CH VOLT)

Channels That Auto Setup Is Performed On

Auto setup is performed on all channels except logic channels.

Logic waveforms are displayed with the same settings as before you executed auto setup.

Waveforms Displayed before the Execution of Auto Setup

When you perform auto setup, the data in the acquisition memory is overwritten, and the waveforms that were displayed before you executed auto setup are cleared.

Undoing Auto Setup

You can press the Undo soft key to revert to the settings that were in effect before you executed auto setup. You cannot undo auto setup if you switch to a different setup menu or clear the SETUP menu using the ESC key.

Signals That Auto Setup Can Be Applied To

Frequency:	Approx. 50 Hz or higher
Absolute input voltage:	Signals whose maximum value is at least approx. 20 mV (at 1:1 setting)
Type:	Simple, repeating signals

Note

The auto setup feature may not work properly for signals that include a DC component or high-frequency components.

Settings after the Execution of Auto Setup

Waveform Acquisition and Display Settings	
T/div	The waveform with the shortest period out of the waveforms affected by auto setup is used to set T/div. T/div is set to the value at which 1.6 to 4 periods of the waveform can be displayed.
START/STOP	START
Acquisition mode	Normal
Acquisition count	Infinite
Record length	10 k
Time base	Int.
Real-time HD recording	Off
Dual capturing	Off
Accumulation	Off
Vertical axis settings	
V/Div	The value that causes the absolute values of the input waveform to be between 1.6 and 4.5 div
Offset voltage	0 V
Coupling	DC
Bandwidth limit	FULL
Display on/off	Channels whose absolute input voltage values reach or exceed 20 mV (1:1) are displayed (except for Scan). The displays of modules that are not affected by auto setup do not change.
DIV/Scale	DIV
Position	0.00 div
V Zoom	×1
Trigger Settings	
Trigger mode	Auto
Trigger type	SIMPLE
Trigger source	The channel with the longest period out of the channels whose amplitude is 1 div or greater
Trigger level/slope	The level between the maximum and minimum values/ rising
Hysteresis	Low
Hold-off	0.0 nsec
Trigger position	50%
Trigger delay	0.0 μsec
Computation Settings	
Math	Off

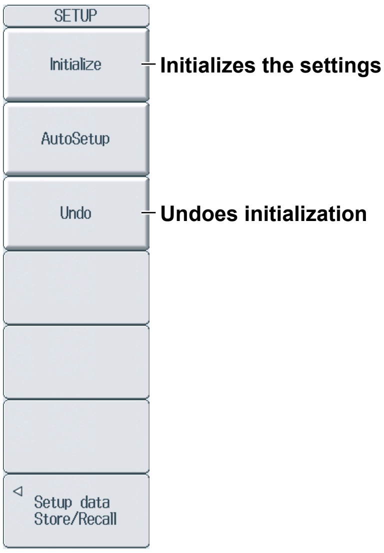
The values of settings not listed here do not change.

4.6 Initializing Settings

You can reset the DL850E/DL850EV settings to their factory default values. This feature is useful when you want to cancel all of the settings that you have entered or when you want to redo measurement from scratch.

SETUP Menu

Press **SETUP** to display the following menu.



Settings That Cannot Be Reset to Their Factory Default Values

- Date and time settings
- Communication settings
- Language setting (English or Japanese)

Undoing the Reset Operation

If you reset the settings by mistake, you can press the Undo soft key to revert to the previous settings. However, you cannot undo the reset operation if you switch to a different setup menu or clear the SETUP menu by pressing the ESC key.

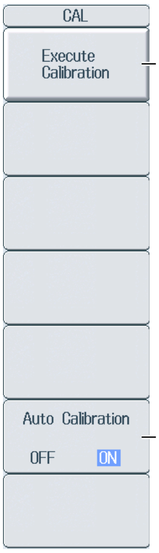
To Reset All Settings to Their Factory Default Settings

While holding down the RESET key, turn the power switch on. All settings except the date and time settings (display on/off setting will be reset) and the setup data stored in internal memory will be reset to their factory default values.

4.7 Calibrating the DL850E/DL850EV

CAL Menu

Press **SHIFT+SETUP** (CAL) to display the following menu.



Executes calibration

Turns auto calibration on and off

Calibration

The following items are calibrated. Execute calibration when you want to make accurate measurements.

- Vertical axis ground level and gain
- Trigger threshold level
- Measured time value for repetitive sampling

Note

Calibration is performed automatically when the power switch is turned on.

Notes about Calibration

- Allow the DL850E/DL850EV to warm up for at least 30 minutes before you execute calibration. If you execute calibration immediately after power-on, the calibrated values may drift due to temperature changes or other environmental changes.
- Execute calibration in an environment with a stable temperature ranging from 5 to 40°C (23 ± 5°C recommended).
- Do not apply signals when calibrating. Calibration may not be executed properly when input signals are being applied to the DL850E/DL850EV.

Auto Calibration (Auto Cal)

Auto calibration is executed when you start signal acquisition if you have changed Time/div and any of the time periods listed below has elapsed since the power was turned on.

- 3 minutes
- 10 minutes
- 30 minutes
- One hour and every hour thereafter

If calibration is executed while signals are being applied to the DL850E/DL850EV, we recommend that you recalibrate the DL850E/DL850EV without any signals being applied to it.

4.8 Starting and Stopping Waveform Acquisition

Starting and Stopping Waveform Acquisition.

Press **START/STOP** to start or stop waveform acquisition.

The key is illuminated while the DL850E/DL850EV is acquiring waveforms.

Waveform Acquisition and Indicators

- When the START/STOP key is illuminated, the DL850E/DL850EV is acquiring waveforms. “Running” appears in the lower left of the screen.
- When the START/STOP key is not illuminated, waveform acquisition is stopped. “Stopped” appears in the lower left of the screen.

DL850E/DL850EV Operation When the Acquisition Mode Is Set to Averaging

- Averaging stops when you stop waveform acquisition.
- If you restart waveform acquisition again, averaging starts from the beginning.

START and STOP Operations during Accumulation

- Accumulation stops when you stop acquisition.
- If you restart waveform acquisition, past waveforms are cleared, and accumulation starts over.

Note

You can use the snapshot feature to retain the displayed waveform on the screen. This feature allows you to retain a waveform on the screen while the DL850E/DL850EV continues signal acquisition.

4.9 Displaying Help

Displaying Help

Press the help key (?) to display help.
The table of contents and index appear in the left frame, and text appears in the right frame.

Switching between Frames

To switch to the frame that you want to control, use the left and right arrow keys.

Moving Cursors and Scrolling

To scroll through the screen or to move the cursor in the table of contents or index, turn the jog shuttle.

Moving to the Link Destination

To move to a description that relates to blue text or to move from the table of contents or index to the corresponding description, move the cursor to the appropriate blue text or item, and press SET.

Displaying Panel Key Descriptions

With help displayed, press a panel key to display an explanation of it.

Returning to the Previous Screen

To return to the previous screen, press RESET.

Hiding Help

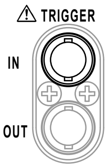
Press the help key (?) to clear help.

5.1 External Trigger Input (TRIGGER IN)

CAUTION

Only apply signals that meet the following specifications. Signals that do not meet the specifications may damage the DL850E/DL850EV, because of factors such as excessive voltage.

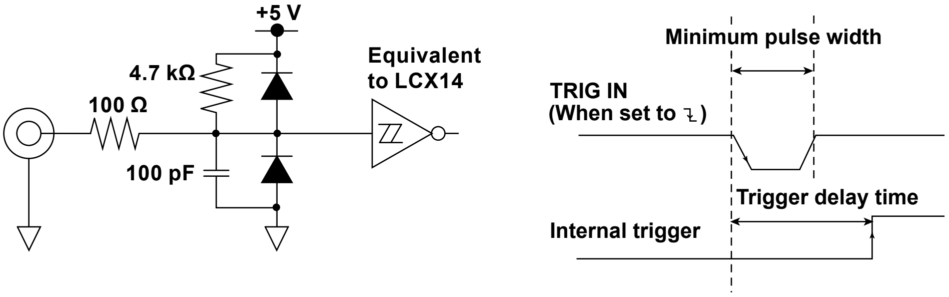
External Trigger Input Terminal


TRIGGER
IN
OUT

This terminal is used when an external signal is used as the trigger source.

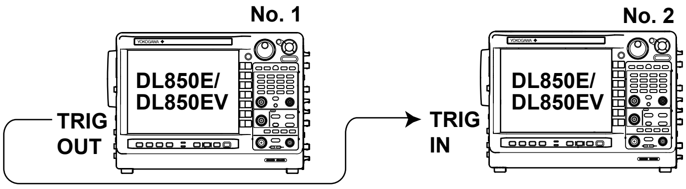
Item	Specifications
Connector type	BNC
Input level	TTL (0 to 5 V)
Minimum pulse width	100 ns
Logic	Rising and falling edges
Trigger delay time	Within 100 ns + 1 sample period
Externally synchronized operation	Possible (through the connection of the TRIG IN and TRIG OUT terminals of two DL850E/DL850EVs)

Circuit Diagram and Timing Chart for External Trigger Input


+5 V
4.7 kΩ
100 Ω
100 pF
Equivalent to LCX14
Minimum pulse width
TRIG IN
(When set to ⎍)
Trigger delay time
Internal trigger

Note

You can synchronize the operation of two DL850E/DL850EVs by using the trigger output function.

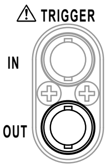

No. 1
DL850E/
DL850EV
TRIG OUT
No. 2
DL850E/
DL850EV
TRIG IN

5.2 Trigger Output (TRIGGER OUT)

CAUTION

Do not short the TRIG OUT terminal or apply external voltage to it. Doing so may damage the instrument.

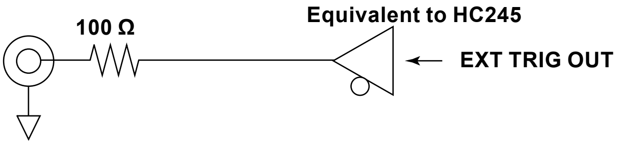
External Trigger Output Terminal

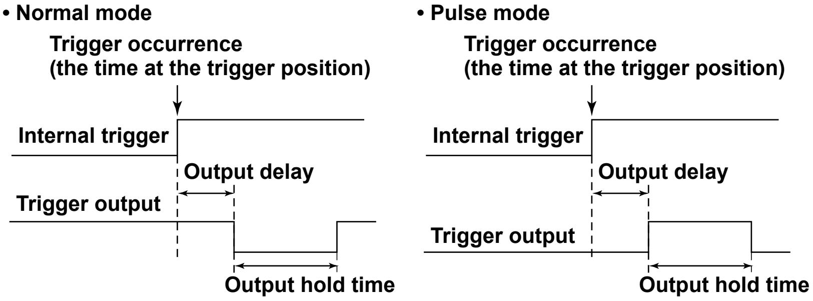

TRIGGER
IN
OUT

When a trigger occurs, the DL850E/DL850EV produces a CMOS level signal. You can set the output mode to normal or pulse. The signal level is normally high. It becomes low when a trigger occurs.

Item	Specifications	
Connector type	BNC	
Output level	CMOS level (0 to 5 V)	
Output formats	Normal mode and pulse mode	
Logic	Normal mode	Low when a trigger occurs and high after acquisition is completed
	Pulse mode	Low when a trigger occurs and high after a specified period of time has passed.
Output delay	Normal mode	Within 100 ns + 1 sample period
	Pulse mode	Within 100 ns + 1 sample period
Output hold time	Normal mode	100 ns or more
	Pulse mode	1 ms, 50 ms, 100 ms, or 500 ms

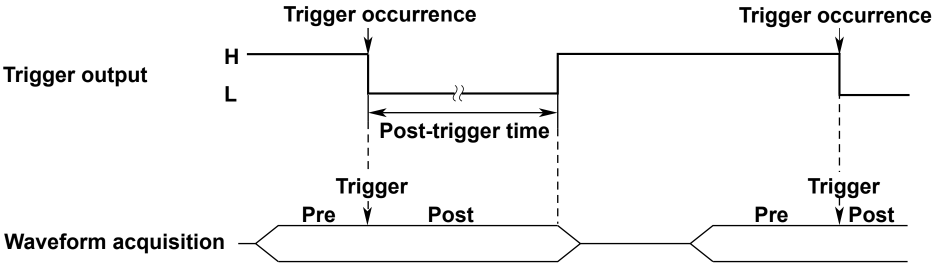
Circuit Diagram and Timing Chart for Trigger Output


100 Ω
Equivalent to HC245
EXT TRIG OUT


- **Normal mode**
- **Pulse mode**

Trigger occurrence
(the time at the trigger position)
Internal trigger
Output delay
Trigger output
Output hold time
Trigger occurrence
(the time at the trigger position)
Internal trigger
Output delay
Trigger output
Output hold time

Low Level and High Level Hold Times (In normal mode)

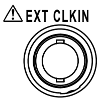

Trigger occurrence
Trigger occurrence
Trigger output
H
L
Post-trigger time
Trigger
Pre
Post
Trigger
Pre
Post
Waveform acquisition

5.3 External Clock Input (EXT CLK IN)

CAUTION

Only apply signals that meet the following specifications. Signals that do not meet the specifications may damage the DL850E/DL850EV, because of factors such as excessive voltage.

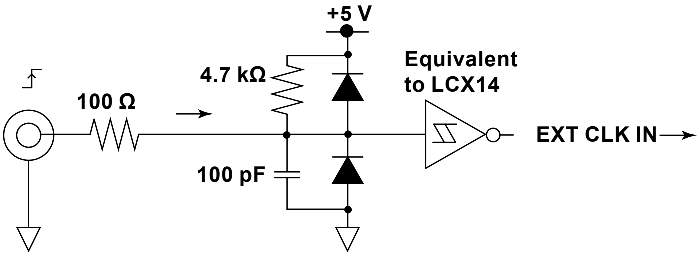
External-clock input terminal



Use this terminal to operate the DL850E/DL850EV using an external clock signal.

Item	Specifications
Connector type	BNC
Input level	TTL (0 to 5 V)
Detected edge	Rising
Minimum pulse width	50 ns or more for both high and low
External clock frequency range	Up to 9.5 MHz

Circuit Diagram for External Clock Input

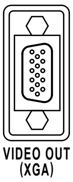


5.4 Video Signal Output (VIDEO OUT (XGA))

CAUTION

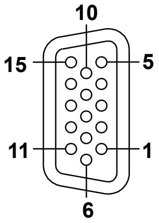
- Only connect the DL850E/DL850EV to a monitor after turning both the DL850E/DL850EV and the monitor off.
- Do not short the VIDEO OUT terminal or apply external voltage to it. Doing so may damage the DL850E/DL850EV.

Video Signal Output Terminal



You can use video signal output to display the DL850E/DL850EV screen on a monitor. Any multisync monitor that supports XGA can be connected.

Item	Specifications
Connector type	D-sub 15-pin
Output format	Analog RGB output
Output resolution	XGA output, 1024 × 768 dots, approx. 60 Hz Vsync



D-Sub 15-pin receptacle

Pin No.	Signal	Specifications
1	Red	0.7 V_{P-P}
2	Green	0.7 V_{P-P}
3	Blue	0.7 V_{P-P}
4	—	
5	—	
6	GND	
7	GND	
8	GND	
9	—	
10	GND	
11	—	
12	—	
13	Horizontal sync signal	Approx. 36.4 kHz, TTL positive logic
14	Vertical sync signal	Approx. 60 Hz, TTL positive logic
15	—	

Connecting to a Monitor

1. Turn off the DL850E/DL850EV and the monitor.
2. Connect the DL850E/DL850EV and the monitor using an RGB cable.
3. Turn on the DL850E/DL850EV and the monitor.

5.5 GO/NO-GO Determination I/O and External Start/Stop Input (EXT I/O)

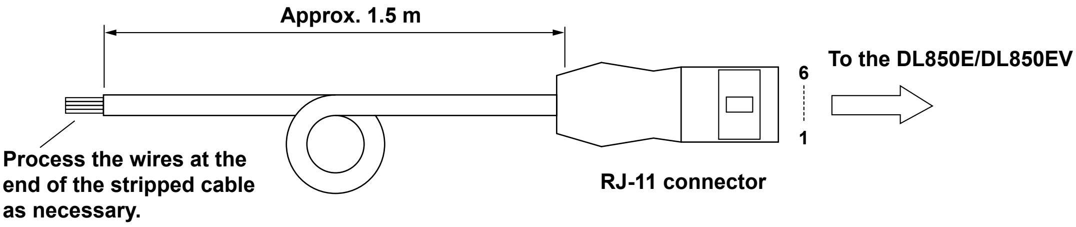
Connecting to Other Instruments

CAUTION

- Do not apply external voltage to the NO-GO OUT and GO OUT output pins. Doing so may damage the instrument.
- When connecting the GO/NO-GO determination signal output to another device, do not connect the wrong signal pin. Doing so may damage the DL850E/DL850EV or the connected instrument.
- Do not connect a USB cable to the GO/NO-GO output terminal. Doing so may damage the instrument.

About the External I/O Cable (720911; sold separately)

- Do not use the cable for anything other than the DL850E/DL850EV external I/O.
- Refer to the following figure to connect the cable to an external device.


Approx. 1.5 m
To the DL850E/DL850EV
6
1
Process the wires at the end of the stripped cable as necessary.
RJ-11 connector

Wire color	Pin no.	Signal	Logic
Red	1	EXT EVENT IN	Negative logic
Yellow	2	START IN	Negative logic
White	3	GO OUT	Negative logic
Green	4	NOGO OUT	Negative logic
Blue	5	GND	

GO/NO-GO Determination I/O

You can apply an external signal to the DL850E/DL850EV's GO/NO-GO I/O terminal and perform GO/NO-GO determination, and you can output the results of GO/NO-GO determination from the GO/NO-GO I/O terminal.

GO/NO-GO I/O Connector

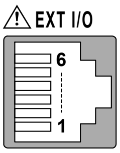
Type

The connector uses an RJ-11 modular jack. Use the external I/O cable accessory (720911; sold separately). If you are using a commercially sold cable (four-conductor modular telephone cable), wire the pins according to the above figure.

I/O Level

Within 0 to 5 V, threshold level: TTL

Pinout



Connector on the DL850E

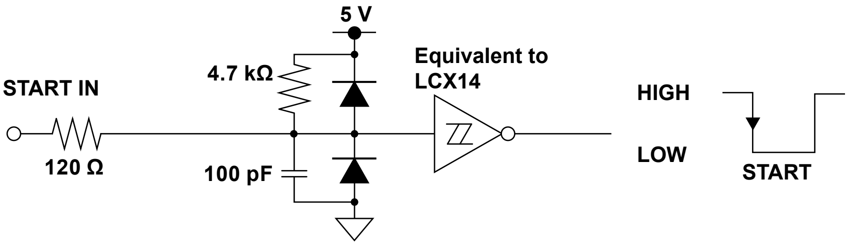
Pin no.	Signal		
1	EXT EVENT IN	IN	Manual event. Event input occurs on low edge.
2	START IN	IN	Starts on low edge
3	GO OUT	OUT	Active low (GO)
4	NOGO OUT	OUT	Active low (NO-GO)
5	GND		
6	NC (no connection)		

Input Signal

START IN (Negative logic)

Use this signal to perform GO/NO-GO determination by synchronizing to an external input signal. The signal is only valid when on the GO/NO-GO menu, Remote is set to ON. If Remote is set to OFF, GO/NO-GO determination is performed regardless of the external signal input (the GO/ NO-GO determination result is output).

Signal Input Circuit


5 V
Equivalent to
LCX14
START IN
4.7 kΩ
120 Ω
100 pF
HIGH
LOW
START

Output Signal

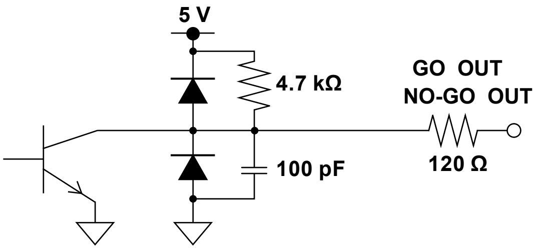
NOGO OUT (Negative logic)

When the determination result is NO-GO (fail), the output signal level temporarily changes from high (H) to low (L).

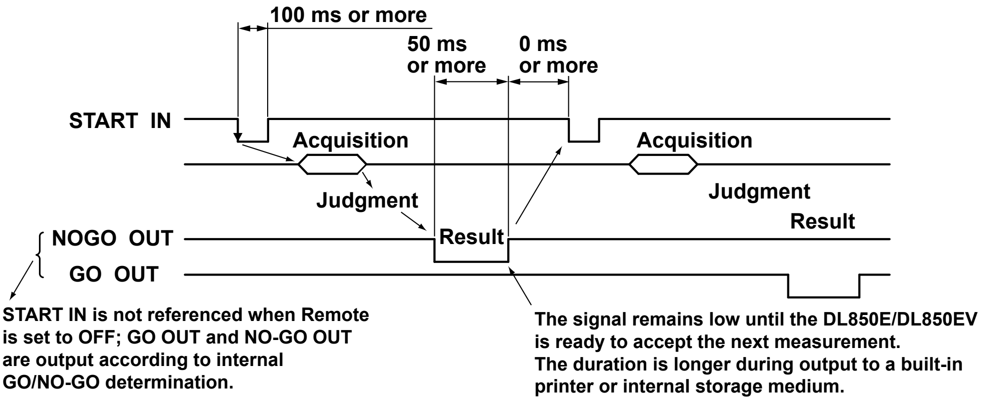
GO OUT (Negative logic)

When the determination result is GO, the output signal level temporarily changes from high (H) to low (L).

Signal Output Circuit


5 V
4.7 kΩ
GO OUT
NO-GO OUT
100 pF
120 Ω

GO/NO-GO I/O Timing


100 ms or more
50 ms or more
0 ms or more
START IN
Acquisition
Acquisition
Judgment
Judgment
Result
Result
NOGO OUT
GO OUT

START IN is not referenced when Remote is set to OFF; GO OUT and NO-GO OUT are output according to internal GO/NO-GO determination.

The signal remains low until the DL850E/DL850EV is ready to accept the next measurement. The duration is longer during output to a built-in printer or internal storage medium.

External Start/Stop Input (EXT I/O)

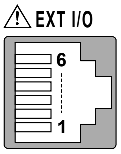
You can use an external signal to start and stop the DL850E/DL850EV.

External Start/Stop Input Terminal

The External Start/Stop Input terminal and the GO/NO-GO I/O terminal are the same terminal. This terminal is used as an external start/stop input when the GO/NO-GO determination I/O function is not used (when on the GO/NO-GO menu, Mode is set to OFF).

Specifications

The connector uses an RJ-11 modular jack. Connect the separately sold 720911 cable to the connector.

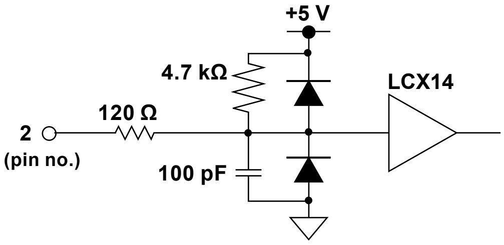


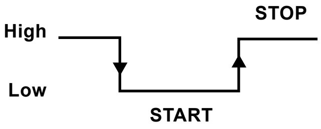
Connector on the DL850E/DL850EV

Pin no.	Signal
1	**EXT EVENT IN—Manual event. Event input occurs on low edge.**
2	**START IN —— Starts on low edge, stops on high**
3	**NC (no connection)**
4	**NC (no connection)**
5	**GND**
6	**NC (no connection)**

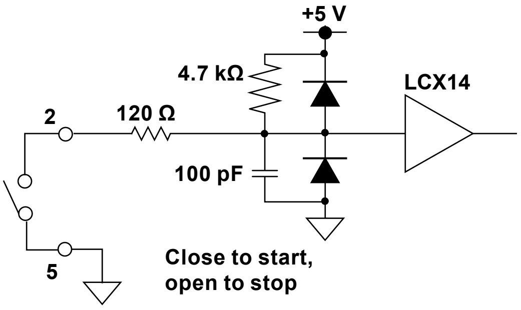
Input level: TTL (0 to 5 V)

Circuit Diagram for External Start/Stop Input





• Contact input is possible



Note

- Low and high edges are used to detect starts and stops.
- You can select whether to enable high edges (stops) in the external start/stop signal or disable. For information about how to do so, see section 18.8, "Configuring the Environment Settings," in the user's manual.

5.6 IRIG Signal Input (IRIG option)

CAUTION

Only apply signals that meet the following specifications. Signals that do not meet the specifications may damage the DL850E/DL850EV, because of factors such as excessive voltage.

IRIG Signal Input Terminal

You can use an IRIG (Inter Range Instrumentation Group) signal to set the time on the DL850E/DL850EV.

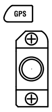
Item	Specifications
Input connector	BNC
Number of input connectors	1
Supported IRIG signals	A002, B002, A132, and B122
Input impedance	You can switch between 50 Ω and 5 kΩ.
Maximum input voltage	±8 V
Used for	Synchronizing the DL850E/DL850EV time Synchronizing the sample clock
Clock sync range	±80 ppm
Post-sync accuracy	No drift from the input signal

5.7 GPS Signal Input (GPS option)

CAUTION

Only apply signals that meet the following specifications. Signals that do not meet the specifications may damage the DL850E/DL850EV, because of factors such as excessive voltage.

GPS Signal Input Terminal



You can use a GPS (Global Positioning System) signal to set the time on the DL850E/DL850EV.

Item	Specifications
Input connector	SMA
Number of input connectors	1
Receiver type	GPS L1 C/A code SBAS:WAAS EGNOS MSAS
Function	DL850E/DL850EV time synchronization Sample clock synchronization
Accuracy after synchronization[1]	± 200 ns (when locked to GPS signal)
Sync time	Within 5 minutes after the power is turned on
Compatible antenna	Active antenna, 3.3 V power supply A1058ER standard accessory

[1] The figure is based on results obtained when the GPS antenna is installed in a location with good line of sight to GPS satellites.
The accuracy may not be attained depending on the measurement location, the location of satellites when the measurement is taken, the weather, and influence caused by obstruction.

6.1 Signal Input Section

Item	Specifications
Type	Plug-in input unit
Number of slots	8
Maximum number of input channels	16 channels per slot, 128 channels per unit (when a 16-CH voltage input module is installed in each slot)
Maximum record length	The maximum length when all channels are being used depends on the number of channels in each module. The maximum values when the entire memory is used are listed below. Standard: 250 Mpoint when 1 channel is being used. 10 Mpoint per channel when 16 channels are being used. /M1 option: 1 Gpoint when 1 channel is being used. 50 Mpoint per channel when 16 channels are being used. /M2 option: 2 Gpoint when 1 channel is being used. 100 Mpoint per channel when 16 channels are being used.
Real Time Math channels (option)[1]	The DL850E/DL850EV is equipped with 16 dedicated channels for performing computations. This enables you to perform the following computations in real time on 16 analog input channels or 16 realtime math output channels: digital filter, basic arithmetic, basic arithmetic with coefficients, differentiation and integration, angle of rotation, logic signal/analog waveform conversion, quartic polynomial, rms value, power, integrated power, common logarithm, square root, cosine, sine, arc tangent, electrical angle, knocking filter, coefficient multiplied by addition or subtraction of sources, frequency, period, edge count, resolver, IIR filter, and demodulation of the pulse width modulated signal. (For detailed specifications of Real Time Math channel's math features, see section 6.5, Features.) Real Time Math features are as follows: • Even when the display is in roll mode, you can view the math results. • There are no restrictions on the record length. You can specify a record length that is the same as a normal input channel. • Math results can be used to trigger the DL850E/DL850EV. • Because both acquisition and computations can be performed at the same time, you can make the waveform update period shorter than it is with normal math operations.

[1] These features are supported by firmware versions 1.30 and later of the DL850E/DL850EV. The following real time math operations are supported by firmware version 2.00 and later: resolver, IIR filter, and demodulation of the pulse width modulated signal.

6.2 Triggering Section

Item	Specifications
Trigger mode	Auto, Auto Level, Normal, Single, N Single, or On Start
Selectable trigger level range	0 ± 10 div
Trigger hysteresis	When measuring voltage: Select from ±0.1 div, ±0.5 div, and ±1 div. When measuring temperature: Select from ±0.5°C, ±1.0°C, and ±2.0°C. When measuring strain: Select from ±2.5%, ±12.5%, and ±25%. When measuring acceleration: Select from ±0.1 div, ±0.5 div, and ±1 div. When measuring frequency: Select from ±0.01 div, ±0.5 div, and ±1 div.
Selectable trigger position range	0 to 100% (of the display record length; resolution: 0.1%)
Selectable trigger delay range	0 to 10 s (resolution: 10 ns)
Selectable hold-off time range	0 to 10 s (resolution: 10 ns)
Manual trigger key	A dedicated manual trigger key can be used.

Item	Specifications
Simple trigger	
Trigger source	CHn (select an input channel), EXT, LINE, or Time
Trigger slope	Rising, falling, or rising or falling
Time trigger	Date (year, month, and day), time (hour and minute), and time interval (10 seconds to 24 hours)
Enhanced trigger	
Trigger source	CHn (select an input channel)
Trigger type	A -> B(N): After the trigger A conditions are met, the DL850E/DL850EV triggers when the trigger B conditions are met N times. Count: 1 to 10000 Condition A: Enter/Exit Condition B: Enter/Exit
	A Delay B: After the specified amount of time elapses after the trigger A conditions are met, the DL850E/DL850EV triggers when the trigger B conditions are first met. Time: 0 to 10 s (resolution: 10 ns) Condition A: Enter/Exit Condition B: Enter/Exit
	Edge on A: While the trigger A conditions are met, the DL850E/DL850EV triggers on the OR of multiple trigger source edges. Condition A: True/False
	AND: The DL850E/DL850EV triggers on the AND of multiple state conditions.
	OR: The DL850E/DL850EV triggers on the OR of multiple trigger source edges or states (or Window triggers)
	Pulse Width:
	B>Time: The DL850E/DL850EV triggers when the time from when the trigger B conditions are met to when they change from being met to not being met is greater than the specified time. Time: 20 ns to 10 s (resolution: 10 ns)
	B<Time: The DL850E/DL850EV triggers when the time from when the trigger B conditions are met to when they change from being met to not being met is less than the specified time. Time: 20 ns to 10 s (resolution: 10 ns)
	B Time Out: The DL850E/DL850EV triggers when the trigger B conditions continue to be met for the specified period of time. Time: 20 ns to 10 s (resolution: 10 ns)
	B Between: The DL850E/DL850EV triggers when the period during which the trigger B conditions continue to be met is within the specified time range. Time T1: 10 ns to 9.99999999 s T2: 20 ns to 10 s (resolution: 10 ns)
	Period: The DL850E/DL850EV triggers when the period meets one of the following conditions.
	T>Time: The DL850E/DL850EV triggers when the period of the trigger T conditions is longer than the specified time. Time: 20 ns to 10 s (resolution: 10 ns)
	T<Time: The DL850E/DL850EV triggers when the period of the trigger T conditions is less than the specified time. Time: 20 ns to 10 s (resolution: 10 ns)
	T1<T<T2: The DL850E/DL850EV triggers when the period of the trigger T conditions is within the specified time range. Time: T1: 20 ns to 10 s (resolution: 10 ns) T2: 30 ns to 10 s (resolution: 10 ns)
	T<T1, T2<T: The DL850E/DL850EV triggers when the period of the trigger T conditions is outside of the specified time range. Time: T1: 20 ns to 10 s (resolution: 10 ns) T2: 30 ns to 10 s (resolution: 10 ns)
	Window: The DL850E/DL850EV triggers when the trigger source enters or exits the range of two specified levels. The DL850E/DL850EV can trigger on the OR of the window triggers of multiple channels.
	Wave Window: This trigger is for monitoring power supplies. The DL850E/DL850EV creates templates in real time by comparing 1, 2, or 4 cycles directly preceding the current waveforms using a tolerance value, compares the current waveforms to the real-time templates, and triggers if one of the current waveforms falls outside of its real-time template.
	• The trigger A and B conditions can be set to High, Low, or Don't Care for each channel. The AND of the conditions (the parallel pattern) is used to determine the result. • For OR and AND, the condition can be set to High, Low, IN, OUT, or Don't Care for each channel.

6.3 Time Axis

Item	Specifications
Selectable time scale range	The display of minutes per div, hours per div, and days per div is also possible. 100 ns/div[1] to 1 s/div (in 1-2-5 steps), 2 s/div, 3 s/div, 4 s/div, 5 s/div, 6 s/div, 8 s/div, 10 s/div, 20 s/div, 30 s/div, 1 min/div to 10 min/div (in 1 min steps), 12 min/div, 15 min/div, 30 min/div, 1 h/div to 10 h/div (in 1 h steps), 12 h/div, 1 day/div, 2 days/div, 3 days/div, 4 days/div, 5 days/div, 6 days/div, 8 days/div, 10 days/div, 20 days/div
Time accuracy[2]	±0.005%
External clock input	Connector type: BNC Input level: TTL level Detected edge: Rising Frequency range: Up to 9.5 MHz Minimum pulse width: 50 ns or more for both High and Low

[1] 1 µs/div when the High-Speed 100 MS/s, 12-Bit Isolation Module (720210) is not installed

[2] Under standard operating conditions after the warm-up time has passed

6.4 Display

Item	Specifications
Display	10.4-inch TFT LCD
Display screen size	210.4 mm × 157.8 mm
Display resolution*	1024 × 768 (XGA)
Resolution of the waveform display	801 × 656 (normal) or 1001 × 656 (wide)
Display format	Divisions: Up to three screen divisions can be displayed at the same time. Each division can contain one of the following windows: TY, ZOOM1, ZOOM2, XY1, XY2, FFT1, or FFT2.

* The LCD may include a few defective pixels (within 5 ppm over the total number of pixels including RGB). The LCD may contain some pixels that are always illuminated or that never light. Please be aware that these are not defects.

6.5 Features

Waveform Acquisition and Display

Item	Specifications	
Acquisition mode	Normal:	Normal waveform acquisition
	Envelope:	The peak values are held at the maximum sample rate regardless of the Time/div setting.
	Averaging:	The number of times to average can be set to 2 to 65536 in 2^n steps.
	Box average:	Increases the A/D resolution by up to 4 bits (16 bits max.).
Record length	1 kpoint, 2.5 kpoint, 5 kpoint, 10 kpoint, 25 kpoint, 50 kpoint, 100 kpoint, 250 kpoint, 500 kpoint, 1 Mpoint, 2.5 Mpoint, 5 Mpoint, 10 Mpoint, 25 Mpoint, 50 Mpoint, 100 Mpoint, 250 Mpoint, 500 Mpoint (on models with the /M1 or /M2 option), 1000 Mpoint (on models with the /M1 or /M2 option), 2000 Mpoint (on models with the /M2 option)	
Zoom	The displayed waveform is expanded along the time axis (up to two locations can be zoomed at separate zoom factors).	
	Auto scrolling:	The DL850E/DL850EV automatically scrolls to the zoom position.
Display format	1, 2, 3, 4, 6, 8, 12, 16 analog waveform windows	
Maximum number of displayed traces	64 traces per display group. You can switch between four display groups.	
Display interpolation	Sampled points can be displayed through the use of dots (OFF), sine interpolation, linear interpolation, or pulse interpolation.	
Graticule	Three graticule types to choose from	
Auxiliary display on/off	Scale values, waveform labels, the extra window, the level indicator, and the numeric display can be turned on and off.	
X-Y display	The X and Y axes can be selected from CHn and MATHn (Max. four traces × two windows).	
Accumulation	Persistence mode	
Snapshot	The currently displayed waveforms can be retained on the screen. Snapshot waveforms can be saved and loaded.	
Clear trace	The displayed waveform is cleared.	
Dual capturing	The data of a single waveform can be acquired at two different sample rates.	
Main waveform	Maximum sample rate:	100 kS/s (roll mode area)
Captured waveform	Maximum sample rate:	100 MS/s*
	Record length:	5 kpoint, 10 kpoint, 25 kpoint, 50 kpoint, 100 kpoint, 250 kpoint, 500 kpoint
Hard disk recording (when the /HD0 or /HD1 option is installed)	Maximum sample rate:	Depends on the number of channels being used. 1 MS/s when 1 channel is being used. 100 kS/s when 16 channels are being used.
	Capacity:	Depends on the amount of free space on the HDD
	Operation overview:	When waveform acquisition occurs according to the specified trigger mode, the DL850E/DL850EV stores the data to an internal hard disk or an external hard disk that supports eSATA.

* 10 MS/s when the High-Speed 100 MS/s, 12-Bit Isolation Module (720210) is not installed

Vertical and Horizontal Control

Item	Specifications
Channel on/off	CHn and MATHn can be turned on and off separately.
ALL CH menu	You configure the settings of all channels while displaying waveforms. You can use a USB keyboard or mouse.
Vertical axis zooming	×0.1 to ×100 (varies depending on the module) You set the scale using upper and lower limits or switch between different scales.
Vertical position setting	Waveforms can be moved in the range of ±5 div from the center of the waveform display frame.
Linear scaling	The linear scaling mode can be set separately for each channel (only for voltage, stress, and frequency). It can be set to AX+B or P1-P2.
Roll mode	Roll mode is enabled automatically when the trigger mode is set to Auto, Auto Level, Single, or On Start, and the time axis setting is greater than or equal to 100 ms/div.

Analysis

Item	Specifications
Zooming and searching	You can search for and then expand and display a portion of the displayed waveform. You can choose from the following search methods. Edge: The DL850E/DL850EV counts the number of rising or falling edges Logic pattern: The DL850E/DL850EV counts the number of times a logic pattern is detected. Event: The DL850E/DL850EV searches for an event number. Time: The DL850E/DL850EV searches for a date and time.
History search feature	You can search through history waveforms for specified conditions. Zone search: The DL850E/DL850EV displays waveforms that pass through or do not pass through a specified area on the screen. Parameter search: The DL850E/DL850EV displays a waveform when the results of the automated measurement of its parameters meet the specified conditions.
Cursor measurement	Horizontal, Vertical, H&V, Degree (only during T-Y waveform display) and Marker
Automated measurement of waveform parameters	Automated measurement of waveform parameters Up to 32 items can be displayed. P-P, Amp, Max, Min, High, Low, Avg, Mid, Rms, SDev, +OverShoot, −OverShoot, Rise, Fall, Freq, Period, +Width, −Width, Duty, Pulse, Burst1, Burst2, AvgFreq, AvgPeriod, Int1TY, Int2TY, Int1XY, Int2XY, Delay(between channels)
Statistical processing	Applicable items: Automated measurement values of waveform parameters Statistical items: Max, Min, Avg, Sdv, and Cnt Maximum number of cycles: 64000 cycles (when the number of parameters is 1) Maximum total number of parameters: 64000 Maximum measurement range: 100 Mpoint
Normal statistical processing	Statistical processing is performed while waveforms are acquired.
Cyclic statistical processing	The DL850E/DL850EV automatically measures the waveform parameters of the data in the acquisition memory and performs statistical processing on the parameters once per period.
Statistical processing of the history data	The DL850E/DL850EV automatically measures the waveform parameters of each history waveform and performs statistical processing on the parameters.
Computation	Operators: +, −, ×, ÷, binary computation, phase shift, and power spectrum
User-defined computation (/G2 option)	Expressions can be created through the combination of the following operators and constants. ABS, SQRT, LOG, EXP, NEG, SIN, COS, TAN, ATAN, PH, DIF, DDIF, INTG, IINTG, BIN, P2, P3, F1, F2, FV, PWHH, PWHL, PWLH, PWLL, PWXX, DUTYH, DUTYL, FILT1, FILT2, HLBT, MEAN, LS-, RS-, PS-, PSD-, CS-, TF-, CH-, MAG, LOGMAG, PHASE, REAL, IMAG
Phase shifting	You can monitor the waveform of a specified channel with its phase shifted
GO/NO-GO determination	The following two types of GO/NO-GO determination are available: • Determination using zones on the screen • Determination using the automated measurement values of waveform parameters. The following operations can be performed at the time of determination: Output of screen capture data, saving of waveform data (to binary, ASCII, or floating-point), sounding of a notification buzzer, transfer of e-mail

Screen Capture Data Output

Item	Specifications
Built-in printer (/B5 option)	A hard copy of the screen can be output.
External printer	Prints screen captures on an external printer connected over an Ethernet or USB.
File format	PNG, JPEG, or BMP

Data Storage

Item	Specifications
History	Automatically holds up to 5000 pages of waveforms (depending on the record length)
Internal HDD and external storage media	Waveform data, setup data, automated measurement values, and the results of statistical processing can be saved.

Real Time Math (Option)

These features are supported by firmware versions 1.30 and later of the DL850E/DL850EV. The following real time math operations are supported by firmware version 2.00 and later: resolver, IIR filter, and demodulation of the pulse width modulated signal.

Item		Specifications			
Math expression		Real Time Math using hardware			
Max. number of math channels		16 (select analog waveform storage or Real Time Math result storage)			
Math source channels		Analog channel 1 to channel 16 (multi-channel modules can also be selected as math sources)			
Math result		16 bits (2400 LSB/div). Results are converted to 16-bit values according to the scaling setting and stored in memory.			
Digital filter		Math can be performed independently on each channel. Math can be performed on up to 16 channels at the same time.			
	Math rate	Max. math rate (sample rate): 1 MS/s. The math rate is selected automatically depending on the set frequency. The possible rates are 1 MS/s, 100 kS/s, 10 kS/s, 1 kS/s and 100 S/s.			
	Filter types	Mean (moving average)			
			Filter format:	FIR (moving average)	
			Filter type:	LPF	
			Number of moving average points:	Selectable from 2, 4, 8, 16, 32, 64, and 128	
		Gauss:			
			Filter format:	FIR	
			Filter type:	LPF	
			Filter order:	5 to 49	
			Cutoff frequency:	300 kHz to 2 Hz	
				Resolution:	300 kHz to 30 kHz, in steps of 2 kHz
				Resolution:	29.8 kHz to 3 kHz, in steps of 200 Hz
				Resolution:	2.98 kHz to 300 Hz, in steps of 20 Hz
				Resolution:	298 Hz to 30 Hz, in steps of 2 Hz
				Resolution:	29.8 Hz to 2 Hz, in steps of 0.2 Hz
			Cutoff characteristic:	–3.0 × $(f/fc)^2$ (where f is the frequency and fc is the cutoff frequency)	
		Sharp:			
			Filter format:	FIR	
			Filter type:	LPF, HPF, BPF	
			Filter order:	5 to 194	
			LPF:	Cutoff frequency: 300 kHz to 2 Hz	
				Resolution:	300 kHz to 30 kHz, in steps of 2 kHz
				Resolution:	29.8 kHz to 3 kHz, in steps of 200 Hz
				Resolution:	2.98 kHz to 300 Hz, in steps of 20 Hz
				Resolution:	298 Hz to 30 Hz, in steps of 2 Hz
				Resolution:	29.8 Hz to 2 Hz, in steps of 0.2 Hz
			HPF:	Cutoff frequency: 300 kHz to 200 Hz	
				Resolution:	300 kHz to 30 kHz, in steps of 2 kHz
				Resolution:	29.8 kHz to 3 kHz, in steps of 200 Hz
				Resolution:	2.98 kHz to 200 Hz, in steps of 20 Hz
			BPF:	Center frequency: 300 kHz to 300 Hz	
				Resolution:	300 kHz to 30 kHz, in steps of 2 kHz
				Resolution:	29.8 kHz to 3 kHz, in steps of 200 Hz
				Resolution:	2.98 kHz to 300 Hz, in steps of 20 Hz
				Bandwidth:	200, 150, 100, 50, 20, 15, 10, 5, 2, 1.5, 1 kHz, 500, 200 Hz (there are limits based on the center frequency)
			Cutoff characteristic:	–40 dB @ 2fc (LPF), –40 dB @ 0.5fc (HPF)	
			Phase:	Linear phase characteristics	

Item		Specifications
		IIR:
		Filter format: IIR (Butterworth)
		Filter type: LPF, HPF, BPF
		Filter order: 4
		LPF: Cutoff frequency: 300 kHz to 2 Hz
		Resolution: 300 kHz to 30 kHz, in steps of 2 kHz
		Resolution: 29.8 kHz to 3 kHz, in steps of 200 Hz
		Resolution: 2.98 kHz to 0.3 kHz, in steps of 20 Hz
		Resolution: 298 Hz to 2 Hz, in steps of 2 Hz
		HPF: Cutoff frequency: 300 kHz to 20 Hz
		Resolution: 300 kHz to 30 kHz, in steps of 2 kHz
		Resolution: 29.8 kHz to 3 kHz, in steps of 200 Hz
		Resolution: 2.98 kHz to 20 Hz, in steps of 20 Hz
		BPF: Center frequency: 300 kHz to 60 Hz
		Resolution: 300 kHz to 12 kHz, in steps of 2 kHz
		Resolution: 11.8 kHz to 1.2 kHz, in steps of 200 Hz
		Resolution: 1.18 kHz to 60 Hz, in steps of 20 Hz
		Bandwidth: 200, 150, 100, 50, 20, 15, 10, 5, 2, 1.5, 1 kHz, 500, 200, 100 Hz (there are limits based on the center frequency)
		Cutoff characteristic: –24 dB/Oct
		Phase: Nonlinear phase characteristics
		IIR-Lowpass filter:
		Filter format: IIR (Butterworth)
		Filter type: LPF
		Filter order: 4
		Cutoff frequency: 128, 64, 32, 16, 8, 4, 2, 1 KHz, 500, 250, 125, 62.5 Hz (no limits based on the sample rate)
	Interpolation	Interpolation can be turned on and off for each channel.
Delay		Delay can be set for each channel.
	Delay	100 ns to 10 ms
	Delay resolution	100 ns to 100 µs, in steps of 100 ns
		101 µs to 1 ms, in steps of 1 µs
		1.01 ms to 10 ms, in steps of 10 µs
Real Time Math		
	Math rate	Max. math rate: 10 MS/s or 1 MS/s for polynomials
	Math type	Basic arithmetic:
		Addition, subtraction, multiplication, and division of two channels (no coefficients)
		Differentiation:
		Differentiation using a fifth order Lagrange interpolation formula
		Integration:
		Integration reset condition: When waveform acquisition starts, when a channel is turned on or off
		Selectable reset conditions: Over limit (±10 div)
		Zero crossing to positive: When the source signal is moving in the positive direction and crosses zero
		Zero crossing to negative: When the source signal is moving in the negative direction and crosses zero
		Basic arithmetic with coefficients:
		Expressions: +, –, ×, /
		Coefficients: A, B, and C can be defined.
		Addition: (A × S1) + (B × S2) + C
		Subtraction: (A × S1) – (B × S2) + C
		Multiplication: (A × S1) × (B × S2) + C
		Division: (A × S1)/(B × S2) + C
		Range of coefficients A, B, and C: –9.9999E+30 to +9.9999E+30

Item	Specifications
	Angle of rotation: Specify the A, B, and Z phase signals, and the angle of the bit signal from the pulse integration logic input is computed as an absolute value. Max. setting of the number of pulses per rotation: 65535
	Logic signal/analog waveform conversion: Uses the logic signal as an analog signal, and performs a scaling conversion
	Quartic polynomial: $A \times s^4 + B \times s^3 + C \times s^2 + D \times s + E$ Range of coefficients A, B, C, D, and E: –9.9999E+30 to +9.9999E+30
	Rms value: $\sqrt{\frac{1}{N}\sum_{n=1}^{N} s(n)^2}$ The math period is from one zero crossing of the specified signal to the next zero crossing. Alternatively, the period is the specified time: 1 to 500 ms, resolution: 1 ms
	Effective power: $\frac{1}{T}\int_{0}^{T}(s1 \cdot s2)dt$ The math period is the integrated value of the time from one zero crossing of the specified signal to the next zero crossing.
	Effective power integration: $\int_{0}^{T}(s1 \cdot s2)dt$ The value “s1 × s2” is integrated over time.
	Common logarithm (Log1): K × Log10(s1/s2)
	Common logarithm (Log2): K × Log10(s1)
	Square root (Sqr1): $\sqrt{s1^2 \pm s2^2}$
	Square root (Sqr2): $\sqrt{s}$
	Cosine: cos(angle)
	Sine: sin(angle)
	Arc tangent: atan(s1/s2)
	Electrical angle: • Calculates the phase difference between (1) the angle that was determined from the logic signals that were specified for phases A, B, and Z, and (2) the fundamental wave component that was determined from the discrete Fourier transform of the waveform that was specified as the target. • Calculates the phase difference (electrical angle) between the angle of rotation and drive current of the motor.
	Knocking filter: When the signal level of the math source waveform that is being differentiated is less than or equal to the elimination level, the output is set to 0.
	Coefficient multiplied by addition or subtraction of sources: K × (s1 ± s2 ± s3 ± s4) Range of coefficient K: –9.9999E+30 to +9.9999E+30
	Period: The period from one edge condition to the next edge condition is measured. Resolution: 100 ns. Max. period: 10 s
	Frequency: The period is measured, and the frequency is calculated as 1/period.

Item		Specifications
		Edge count: Counts the specified edges
		IIR: Filter format: IIR (Butterworth) Filter type: LPF, HPF, BPF Filter order: 4
		LPF: Cutoff frequency: 3 MHz to 0.2 Hz Resolution: 3 MHz to 300 kHz, in steps of 20 kHz Resolution: 298 kHz to 30 kHz, in steps of 2 kHz Resolution: 29.8 kHz to 3 kHz, in steps of 200 Hz Resolution: 2.98 kHz to 0.3 kHz, in steps of 20 Hz Resolution: 298 Hz to 30 Hz, in steps of 2 Hz Resolution: 29.8 Hz to 0.2 Hz, in steps of 0.2 Hz HPF: Cutoff frequency: 3 MHz to 20 Hz Resolution: 3 MHz to 300 kHz, in steps of 20 kHz Resolution: 298 kHz to 30 kHz, in steps of 2 kHz Resolution: 29.8 kHz to 3 kHz, in steps of 200 Hz Resolution: 2.98 kHz to 20 Hz, in steps of 20 Hz BPF: Center frequency: 3 MHz to 60 Hz Resolution: 3 MHz to 120 kHz, in steps of 20 kHz Resolution: 118 kHz to 12 kHz, in steps of 2 kHz Resolution: 11.8 kHz to 1.2 kHz, in steps of 200 Hz Resolution: 1.18 kHz to 60 Hz, in steps of 20 Hz Bandwidth: 2, 1.5, 1 MHz, 500, 200, 150, 100, 50, 20, 15, 10, 5, 2, 1.5, 1 kHz, 500, 200, 100 Hz (there are limits based on the center frequency) Cutoff characteristic: –24 dB/Oct Phase: Nonlinear phase characteristicst Interpolation: Interpolation can be turned on and off.
		Resolver: The angle of rotation is computed from the carrier signal, sine signal, and cosine signal. Supported carrier frequencies: 1 kHz to 20 kHz Tracking filter band setting: 2 kHz, 1 kHz, 250 Hz, 100 Hz Maximum measurable angular acceleration: 140000 rps^2 (when the tracking filter is set to 2 kHz) 54000 rps^2 (when the tracking filter is set to 1 kHz) 1800 rps^2 (when the tracking filter is set to 250 Hz) 180 rps^2 (when the tracking filter is set to 100 Hz)
		Demodulation of the pulse width modulated (PWM) signal: The PWM-modulated signal is integrated over the modulation period and converted into an analog signal.
		Reactive power The reactive power is computed from apparent power and effective power.
		CAN ID detection The frame of the CAN bus signal with the specified ID is detected.
		Torque: The torque is computed from the measured frequenvy and the specified coefficient.
	Math source waveforms	• Analog channels 1 to 16 and the sub channels of scanner and CAN modules. • Math results can be specified as sources of another channel. • However, you can only specify math results of channels whose numbers are smaller than the channel that you are specifying sources for.
	Math delay	A uniform delay for each math operation, regardless of the number of math channels
	Mean	The mean can be calculated on the math results. Number of taps: 32 (fixed) The calculation period changes automatically according to the DL850E/DL850EV sample rate.

Item		Specifications
Zoom Method		
	Zooming by Setting a Magnification	V Zoom is set in steps of 1, 2, or 5 to a value in the range of 10.00E–21 to 500.0E+18.
	Zooming by Setting Upper and Lower Display Limits	Upper limit: ±5.0000E+22; lower limit: ±1.0000E–23

Power Math (Option)

Item		Specifications
Math expression		Real time math using hardware
Math source channels		Analog channel 1 to channel 16 (multi-channel modules cannot be selected as math sources)*
Max. math rate		10 MS/s
Math data update rate		100 kS/s max.
Math result output channels		Power analysis math CH13, CH14; harmonic analysis math CH15, CH16 (fixed)
Math result		16 bits (2400 LSB/div)
		Results are converted to 16-bit values according to the scaling setting and stored in memory.
Power analysis		
	Max. number of analyzable systems	Up to two three-phase systems can be computed simultaneously.
	Max. number of simultaneous math parameters	126 when one system is measured 54 × 2 systems when two systems are measured
	Supported wiring systems	Single-phase, two-wire (1P2W); single-phase, three-wire (1P3W); or three-phase, three-wire (3P3W), Three-phase, three wire system that uses a three-voltage, three-current method (3P3W; 3V3A); three-phase, four-wire system (3P4W)
	Delta math function	Three-phase, three-wire (3P3W) → three-phase, three wire system that uses a three-voltage, three-current method (3P3W; 3V3A) Three-phase, three-wire (3V3A) → three-phase, four-wire system (3P4W) (delta → star) Three-phase, four-wire system (3P4W) → three-phase, three-wire (3V3A) (star → delta)
	Math items	Rms voltage and current of each phase Voltage and current simple average of each phase (DC) AC voltage and current components of each phase (AC) Active power Apparent power Reactive power Power factor Current phase difference Voltage and current frequencies Maximum voltage and current, minimum voltage and current Maximum power, minimum power Integrated watt-hour, integrated watt-hour of each polarity (positive and negative) Integrated ampere-hour, integrated ampere-hour of each polarity (positive and negative) Apparent energy Reactive energy Impedance of the load circuit Series resistance of the load circuit Series reactance of the load circuit Parallel resistance of the load circuit Parallel reactance of the load circuit Three-phase voltage unbalanced factor Three-phase current unbalanced factor Motor output math Power efficiency (select motor output result and power math result or power math result of two systems

Item	Specifications
Rms math system	Select true rms value or rectified mean value calibrated to the rms value
Math sync mode	Edge: Select a signal. Computed using zero-crossings. Auto Timer: Specify the time. Computed at specified time intervals. AC: Select a signal. Computed using zero-crossings. Signal stop determined by a stop prediction function. AC+DC: Select a signal. Computed using zero-crossings. Signal stop determined by a stop prediction function. Switches to Auto Timer after stopping.
Channel selection for edge	Select a single channel from own phase voltage, own phase current, or other voltage/current.
Sync channel filter	If sync mode is set to Edge, low-pass filter can be selected. Cutoff frequency: Select from 128 kHz, 64 kHz, 32 kHz, 16 kHz, 8 kHz, 4 kHz, 2 kHz, 1 kHz, 500 Hz, 250 Hz, 125 Hz, and 62.5 Hz.
Harmonic analysis	
Max. number of analyzable systems	1 system
Max. number of analyzable frequencies	Fundamental wave 1 kHz
FFT points	512
Supported wiring systems	Single-phase, two-wire (1P2W); single-phase, three-wire (1P3W); or three-phase, three-wire (3P3W), Three-phase, three wire system that uses a three-voltage, three-current method (3P3W; 3V3A); three-phase, four-wire system (3P4W)
Delta math function	Three-phase, three-wire (3P3W) → three-phase, three wire system that uses a three-voltage, three-current method (3P3W; 3V3A) Three-phase, three-wire (3V3A) → three-phase, four-wire system (3P4W) (delta → star) Three-phase, four-wire system (3P4W) → three-phase, three-wire (3V3A) (star → delta)
Math mode	Rms analysis mode, power analysis mode
Math items	Rms analysis mode: Rms values of the 1st to 40th harmonic Rms percentage content of the 1st to 40th harmonic Phase angles of the 1st to 40th harmonic Total rms value Distortion factor (IEC) Distortion factor (CSA)
	Power analysis mode: Active powers from the 1st to the 35th harmonic Active power percentage content from the 1st to the 35th harmonic Phase angles of the 1st to 35th harmonic Total active powers Total reactive powers Total apparent powers Power factor 1st harmonic rms voltage 1st harmonic rms current 1st harmonic voltage phase angle 1st harmonic current phase angle
Sync channel	Rms analysis mode: Analysis source channel Power analysis mode: Select one channel from voltage and current.
Sync channel filter	Low-pass filter can be selected. Cutoff frequency: Select from 128 kHz, 64 kHz, 32 kHz, 16 kHz, 8 kHz, 4 kHz, 2 kHz, 1 kHz, 500 Hz, 250 Hz, 125 Hz, and 62.5 Hz.

* If power math is not to be performed, the data on channels 13 to 16 are also applicable.
Example: If only harmonic analysis is to be performed, the data on channels 1 to 14 are applicable.

Other Features

Item	Specifications
Initialization	Resets settings to the factory default (excluding the date and time setting, communication interface settings, language setting, and time difference from GMT setting). The reset can be undone.
Auto setup	Automatically sets the voltage axis, time axis, trigger, etc. The automatic settings can be undone.
Action	Outputs screen capture data, saves waveform data (to binary, ASCII, or floating-point), sounds a notification buzzer, transfers an e-mail, or performs some combination of the previous actions whenever a trigger occurs or waveform acquisition stops
E-mail transmission	Sends e-mail using SMTP
Calibration	Auto or manual
System settings	Screen color, date and time, message language, menu language, click sound on/off, and grid thickness
Overview	The system specifications can be displayed.
Self tests	Memory test, key test, printer test, and storage test
Help feature	Displays a description of the settings
PROTECT key	You can lock the keys to prevent unintentional operations.
NUM key	You can enter numbers directly.
Japanese string input	Compact-VJE Ver.3.0

6.6 FFT

Item	Specifications
Waveform to be computed	CHn or MATHn
Number of channels	1 (on models without the /G2 option), 2(on models with the /G2 option)
Computation range	From the specified computation start point until the specified number of points have been computed
Computed points	1 k, 2 k, 5 k, 10 k, 20 k, 50 k, or 100 k
Time windows	Rect, Hanning, Hamming, FlatTop, and Exponential (on models with the /G2 option) When the Exponential time window is selected, the following settings must be configured. Damping rate: The weight of the last data point, with the weight of the first data point in the specified number of FFT points taken to be 100% (= 1). Selectable range: 1 to 100% Resolution: 1% Force1: Set the area over which computation is performed in terms of a percentage from the first FFT point, taking the number of FFT points to be 100%. Selectable range: 1 to 100% Resolution: 1% Force2: This setting applies to the output (response) signal (second parameter) of a two-waveform FFT. Selectable range: 1 to 100% Resolution: 1%
Display window	The FFT computation results are displayed in a separate window independent from the normal waveform display. Display range: Set the display range by setting Center and Sensitivity.

6.7 Built-in Printer

Item	Specifications
Print system	Thermal line dot system
Sheet width	112 mm
Effective print width	104 mm (832 dots)
Dot density	8 dot/mm
Feeding direction resolution	8 dot/mm
Used for	Producing a hard copy of the screen

6.8 Storage

SD Memory Card

Item	Specifications
Number of slots	1
Maximum capacity	16 GB
Supported cards	SD and SDHC compliant memory cards

Internal HDD (/HD1 option)

Item	Specifications
Number of drives	1
Size	2.5 in.
HDD capacity used	160 GB, FAT32

USB Ports for Peripherals

Item	Specifications
Compatible USB storage devices	Mass storage devices that are compliant with USB Mass Storage Class Ver. 1.1

External HDD Interface (/HD0 option)

Item	Specifications
Connection interface	eSATA
Number of drives	1
Usable HDD capacity	1.5 TB, FAT32

6.9 USB for Peripherals

Item	Specifications
Connector type	USB type A (receptacle)
Electrical and mechanical specifications	USB Rev. 2.0 compliant
Supported transfer mode	HS (High Speed; 480 Mbps), FS (Full Speed; 12 Mbps), LS (Low Speed; 1.5 Mbps)
Compatible devices	Mass storage devices that are compliant with USB Mass Storage Class Ver. 1.1 104 or 109 keyboards that are compliant with USB HID Class Version 1.1 Mouse devices that are compliant with USB HID Class Version 1.1
Number of ports	2
Power supply	5 V, 500 mA (for each port)

6.10 Auxiliary I/O Section

External Trigger Input (TRIGGER IN)

Item	Specifications
Connector type	BNC
Input level	TTL
Minimum pulse width	100 ns
Detected edge	Rising or falling
Trigger delay time	Within 100 ns + 1 sample

Trigger Output (TRIGGER OUT)

Item	Specifications
Connector type	BNC
Output level	5 V CMOS
Logic	Low when a trigger occurs and high after acquisition is completed
Output delay	Within 100 ns + 1 sample
Output hold time	100 ns or more

External Clock Input (EXT CLK IN)

Item	Specifications
Connector type	BNC
Input level	TTL
Minimum pulse width	50 ns
Detected edge	Rising
Sampling jitter	Within 100 ns + 1 sample

Video Signal Output (VIDEO OUT)

Item	Specifications
Connector type	D-sub 15 pin receptacle
Output format	Analog RGB
Output resolution	XGA-compliant output, 1024 × 768 dots Approx. 60 Hz Vsync (dot clock frequency: 66 MHz)

GO/NO-GO Determination I/O

Item	Specifications
Connector type	RJ-11 modular jack
Input level	TTL or contact
Output level	5 V CMOS

External Start/Stop Input

Item	Specifications
Connector type	RJ-11 modular jack
Input level	TTL or contact

COMP Output (Probe-compensation-signal output terminal)

Item	Specifications
Output signal frequency	1 kHz ± 1%
Output amplitude	1 Vp-p ± 10%

Probe Power Output (/P4 Option)

Item	Specifications
Number of output terminals	4
Output voltage	±12 V
Output current	Up to 1 A

Time Sync Signal Input (IRIG; /C20 option)

Item	Specifications
Input connector	BNC
Number of input connectors	1
Supported IRIG signals	A002, B002, A132, and B122
Input impedance	You can switch between 50 Ω and 5 kΩ.
Maximum input voltage	±8 V
Used for	Synchronizing the DL850E/DL850EV time Synchronizing the sample clock
Clock sync range	±80 ppm
Post-sync accuracy	No drift from the input signal

GPS Interface (/C30 option)

Item	Specifications
Input connector	SMA
Number of input connectors	1
Receiver type	GPS L1 C/A code SBAS:WAAS EGNOS MSAS
Function	DL850E/DL850EV time synchronization Sample clock synchronization
Accuracy after synchronization[1]	± 200 ns (when locked to GPS signal)
Sync time	Within 5 minutes after the power is turned on
Compatible antenna	Active antenna, 3.3 V power supply A1058ER standard accessory

[1] The figure is based on results obtained when the GPS antenna is installed in a location with good line of sight to GPS satellites. The accuracy may not be attained depending on the measurement location, the location of satellites when the measurement is taken, the weather, and influence caused by obstruction.

6.11 Computer Interface

USB-PC Connection

Item	Specifications
Connector type	USB type B receptacle
Electrical and mechanical specifications	USB Rev. 2.0 compliant
Supported transfer mode	HS (High Speed; 480 Mbps) and FS (Full Speed; 12 Mbps)
Number of ports	1
Supported protocols	Functions as a device that conforms to one of the following two protocols. USBTMC-USB488 (USB Test and Measurement Class Ver. 1.0)* GP-IB commands can be used through USB. Mass Storage Class Ver.1.1 Only reading from a PC to the internal hard disk of the DL850E/DL850EV is possible. (Operations, such as writing, deleting and formatting, are impossible.)
PC system requirements	A PC with a USB port, running the English or Japanese version of Windows 7 (32 bit), Windows Vista (32 bit), or Windows XP (32 bit, SP2 or later)

* A separate driver is required.

Ethernet

Item	Specifications
Connector type	RJ-45 modular jack
Ports	1
Electrical and mechanical specifications	IEEE802.3
Transmission system	Ethernet (1000BASE-T, 100BASE-TX, 10BASE-T)
Communication protocol	TCP/IP
Supported services	DHCP, DNS, SNTP client, SMTP client, FTP server and client, LPR, Web server, and VXI11

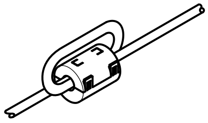
GP-IB (/C1 or /C20 option)

Item	Specifications
Connector type	24-pin connector
Electrical specifications	Complies with IEEE St'd 488-1978 (JIS C 1901-1987)
Functional specifications	SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT0, and C0
Protocol	IEEE St'd 488.2-1992
Code	ISO (ASCII)
Mode	Addressable mode
Address	Talker and listener addresses can be specified from 0 to 30.
Remote mode release	Remote mode can be cleared with the SHIFT+CLEAR TRACE key (except during Local Lockout).

6.12 General Specifications

Item	Specifications
Standard operating conditions	Ambient Temperature: 23 ± 5°C Ambient humidity: 20 to 80% RH Supply voltage and frequency errors: Within ±1% of rating After the DL850E/DL850EV has been warmed up for 30 minutes and then calibration has been performed
Recommended calibration period	1 year
Warm-up time	At least 30 minutes
Storage environment	Temperature: −20 to 60°C Humidity: 20 to 85% RH (no condensation) Altitude: 3000 m or less
Operating environment	Temperature: 5 to 40°C Humidity: 20 to 85% RH (when the printer is not being used) 35 to 85% RH (when the printer is used) In both cases, no condensation Altitude: 2000 m or less
Standard model	
Rated supply voltage	100 to 120 VAC, 220 to 240 VAC (auto switching)
Permitted supply voltage range	90 to 132 VAC, 198 to 264 VAC
Rated supply frequency	50/60 Hz
Permitted supply voltage frequency range	48 to 63 Hz
Power fuse	Built in (not replaceable)
Maximum power consumption	200 VA
Withstand voltage	1500 VAC for one minute between the power supply and case
Insulation resistance	10 MΩ or more for 500 VDC between the power supply and case
External dimensions	Approx. 355 mm (W) × 259 mm (H) × 180 mm (D), not including the handle and protrusions
Weight	Approx. 6.5 kg (weight of the DL850E/DL850EV only without paper and with the /M2, /HD1, /C1, and /P4 options installed)
Instrument cooling method	Forced air cooling. Exhaust on the left side and top panel.
DL850EV DC power supply model (/DC option; the AC power supply specifications are the same as those shown for the standard model)	
Supply format	Auto DC/AC switching (AC preferred), isolation between DC power input terminal and the DL850EV
Rated supply voltage	12 VDC
Permitted supply voltage	10 to 18 VDC
Power consumption	Approx. 90 VA (typical[1]): When driving 2 channels (High-Speed 10 MS/s, 12-Bit Isolation Module × 1) Approx. 105 VA (typical[1]): When driving 8 channels (High-Speed 100 MS/s, 12-Bit Isolation Module × 2 and High-Speed 10 MS/s 12-Bit Isolation Module × 2) Approx. 135 VA (typical[1]): When driving 16 channels (High-Speed 100 MS/s, 12-Bit Isolation Module × 4 and High-Speed 10 MS/s 12-Bit Isolation Module × 4)
Maximum power consumption	Approx. 150 VA
Standby power (during DC standby)	30 mW (typical[1], DC power consumption when power is supplied both to AC and DC power)
Voltage input protection circuit	Overcurrent detection: Breaker (15 A) Reverse connection protection: Breaker shutdown Undervoltage detection: Cut off at a voltage less than approx. 9.5 V Overvoltage detection: Cut off at a voltage greater than approx. 18 V
Withstand voltage	30 VDC for one minute between the DC power input terminal and earth terminal
External dimensions	Approx. 355 mm (W) × 250 mm (H) × 200 mm (D), (DL850EV with the /DC option installed, not including the handle and protrusions)
Weight	Approx. 7.4 kg (only the DL850EV with all options (/M3/C8/C10/P4/DC options) Approx. 9.8 kg (DL750 (with /DC option) + eight High-speed 10 MS/s, 12-Bit Isolation Modules) Weight increase by the DC power option Approx. 800 g
Indicator function	Indicates the status of the power supply to the DL850EV using two LEDs
Instrument cooling method	Forced air cooling. Exhaust on the left side and top panel. In DC mode, air is vented from the left side, top panel, and rear panel.

6.12 General Specifications

Item	Specifications
Battery backup	The settings and clock are backed up with an internal lithium battery.
Backup battery life	Approx. five years (at an ambient temperature of 25°C)
Safety standard	Compliant standards EN61010-1, EN61010-2-030, EN61010-031, EN 60825-1 • Overvoltage category (installation category) II[3] • Measurement Category: See the specifications of each module.[4] • Pollution degree 2[5] Approved (DL850E/DL850EV, 701250, 701251, 701255, 701267, 701261, 701262, 701265, 701270, 701271, 701275, 701280, 720210, 720220, 720221, 720230, 720240, 720241, 700986, 700987, 701953, 701955, 701956, 701957, 701958, 702911, 702912) • Bridgehead for the strain module Use the 701955 or 701956 with the 701270, and use the 701957 or 701958 with the 701271.
Emissions	Compliant standards EN61326-1 ClassA, EN61326-2-1, EN 55011 Class A, Group 1, EMC Regulatory Arrangement in Australia and New Zealand EN 55011 Class A, Group 1, Korea Electromagnetic Conformity Standard (한국 전자파적합성기준) Approved (DL850E/DL850EV, 701250, 701251, 701255, 701267, 701261, 701262, 701265, 701270, 701271, 701275, 701280, 720210, 720220, 720221, 720230, 720240, 720241, 700986, 700987, 701953, 701955, 701956, 701957, 701958, 702911, 702912) EN61000-3-2, EN61000-3-3 This product is a Class A (for industrial environments) product. Operation of this product in a residential area may cause radio interference in which case the user is required to correct the interference. Test items 1. Power supply terminal noise 2. Radiation emission 3. Power supply harmonic regulation 4. Power supply voltage fluctuation and flicker Cable conditions (DL850E/DL850EV) Current probe When connecting a current probe to the input terminal and probe power terminal of a module, attach a single ferrite core[6] to both cables on the side of the cables closest to the DL850E/DL850EV. GP-IB cable Use a shielded cable that is 3 m or less in length. USB cable Use a shielded cable that is 3 m or less in length, and attach a ferrite core[6] to the side of the cable closest to the DL850E/DL850EV. Ethernet cable Use a shielded cable that is 3 m or less in length, and attach a ferrite core[6] to the side of the cable closest to the DL850E/DL850EV. External clock input, external trigger input, external trigger output Use a shielded cable that is 3 m or less in length, and attach a ferrite core[6] to the side of the cable closest to the DL850E/DL850EV. IRIG cable Use a shielded cable that is 3 m or less in length, and attach a ferrite core[6] to the side of the cable closest to the DL850E/DL850EV. External HDD cable Use a shielded cable that is 3 m or less in length. Video signal output cable Use a shielded cable that is 3 m or less in length, and attach a ferrite core[7] to the side of the cable closest to the DL850E/DL850EV. External I/O cable Use a shielded cable that is 3 m or less in length, and attach a ferrite core[6] to the side of the cable closest to the DL850E/DL850EV. DC power cable Attach a ferrite core[7] to the DC power cable. Probe power cable Use the dedicated cable, and wrap it once around a ferrite core[6] on the side of the cable closest to the DL850E/DL850EV. Example of wrapping the cable around once 

Item	Specifications
	Cable conditions (input module) Isolated probe 700929 (for the 701250, 701251, 701255, 701275, and 720210) Wrap the cable once around a ferrite core[6] on the side of the cable closest to the DL850E/DL850EV. Twisted pair cable for the 701261, 701262, and 701265 Use a cable that is 3 m or less in length, and wrap the cable once around a ferrite core[6] on the side of the cable closest to the DL850E/DL850EV. Twisted pair cable for the 720220 and 720221(701953) Use a cable that is 3 m or less in length, and wrap the cable once around a ferrite core[8] on the side of the cable closest to the DL850E/DL850EV. Measurement lead 758933 (for the 701267) Bundle the H and L measurement leads. Attach a ferrite core[6] to the DL850E/DL850EV side of the bundled leads. D-sub 9-pin shielded cable (for the 720240 and 720241) Use a cable that is 3 m or less in length, and attach a ferrite core[6] to the side of the cable closest to the DL850E/DL850EV. Bridgeheads 701955 and 701956 (for the 701270) Use a cable that is 5 m or less in length, and attach a ferrite core[6] to the side of the cable closest to the DL850E/DL850EV. Bridgeheads 701957 and 701958 (for the 701271) Use a cable that is 5 m or less in length, and attach a ferrite core[6] to the side of the cable closest to the DL850E/DL850EV. Logic probe input cables 700986, 700987, 702911, and 702912 (for the 720230) Attach a ferrite core[6] to the side of the cable closest to the DL850E/DL850EV.
Immunity	Compliant standards EN61326-1 Table 2 (for use in industrial locations), EN61326-2-1 Approved (DL850E/DL850EV, 701250, 701251, 701255, 701267, 701261, 701262, 701265, 701270, 701271, 701275, 701280, 720210, 720220, 720221, 720230, 720240, 720241, 700986, 700987, 701953, 701955, 701956, 701957, 701958, 702911, 702912) Influence in the immunity environment (criteria A) Noise increase 701250: ≤±20 mV (1:1 input, 5 mV/div conversion) 701251: ≤±3 mV (1:1 input, 1 mV/div conversion) 701255: ≤±25 mV (1:1 input, 5 mV/div conversion) 701267: ≤±30 mV (1:1 input, 20 mV/div conversion) 701261: ≤±3 mV (5 mV/div range conversion) 701262: ≤±3 mV (5 mV/div range conversion) 701265: ≤±0.05 mV (0.1 mV/div) 701270: ≤±100 μSTR (±500 μV range, gauge factor = 2) 701271: ≤±100 μSTR (±500 μV range, gauge factor = 2) 701275: ≤±6 mV (1:1 input, 5 mV/div range conversion) 701280: ≤±0.01 Hz (frequency, 0.1 Hz/div conversion) 720210: ≤±50 mV (1:1 input, 10 mV/div range conversion) 720220: ≤±20 mV (0.2 V/div range conversion) 720221: ≤±2 mV (1 mV/div range; data update period = 100 ms when you are using the 701953) 720230: No bit errors 720240: No erros 720241: No erros Test conditions 701250: 10 MS/s, envelope mode, 50 mV/div, no input filter, with the tip of the probe (700929 (10:1)) shorted 701251: 1 MS/s, envelope mode, 10 mV/div, no input filter, with the tip of the probe (700929 (10:1)) shorted 701255: 10 MS/s, envelope mode, 50 mV/div, no input filter, with the tip of the probe (701940 (10:1)) shorted 701267: 100 kS/s, envelope mode, 0.2 V/div, no input filter, with the end of the cable shorted 701261: 100 kS/s, envelope mode, 5 mV/div, no input filter, with the end of the cable shorted 701262: 100 kS/s, envelope mode, 5 mV/div, no input filter, with the end of the cable shorted 701265: 500 S/s, envelope mode, 0.1 mV/div, no input filter, with the end of the cable shorted

Item	Specifications	
	701270:	100 kS/s, envelope mode, 500 μSTR, gauge factor: 2.0, no input filter 701955 bridge voltage: 2 V 701956 bridge voltage: 10 V
	701271:	100 kS/s, envelope mode, 500 μSTR, gauge factor: 2.0, no input filter 701957 bridge voltage: 2 V 701958 bridge voltage: 10 V
	701275:	100 kS/s, envelope mode, 50 mV/div, no input filter, with the tip of the probe (700929 (10:1)) shorted
	701280:	25 kS/s, envelope mode, Frequency, no input filter, with the tip of the probe shorted
	720210:	100 M/s, envelope mode, 0.1 V/div, no input filter, with the tip of the probe (700929 (10:1)) shorted
	720220:	12.5 kS/s, envelope mode, 0.2 V/div, no input filter, with the end of the cable shorted
	720221:	25 kS/s, envelope mode, 1 mV/div, data update period = 100 ms with the end of the cable shorted when you are using the 701953
	720230:	Logic probes 700986, 700987, 702911, and 702912, with the tips of the logic probes shorted
	720240:	Bit rate: 1 Msps, one shot operation
	720241:	Bit rate: 19.2 kbps, external signal input
	Test items 1. Electrostatic discharge Air discharge: ±8 kV. Contact discharge: ±4 kV. Criteria B. 2. Radiated immunity 80 M to 1 GHz, 10 V/m, 1.4 G to 2 GHz, 3 V/m, 2 GHz to 4.0 GHz, 3 V/m, criteria A 3. Conducted immunity 3 V, criteria A 4. Fast transient/burst Power line: ±2 kV. Signal line: ±1 kV, criteria B 5. Power frequency magnetic field Omitted, because the device does not exert considerable influence on the magnetic field 6. Surge immunity ±1 kV between lines, ±2 kV common, criteria B 7. Voltage dip and interruption 1 cycle, 100%, criteria B Other tests, criteria C	
	Definitions of criteria	
	Criteria A:	During testing, “influence in the immunity environment” described above is met.
	Criteria B:	The instrument continues to function and is controllable throughout testing. The instrument does not change operation modes, and data changes do not persist.
	Criteria C:	Temporary losses of functionality (such as measurement stopping, etc.) are recovered from through the intervention of the operator.

1 The typical value is a representative or standard value. It is not strictly warranted.

2 If the 701260 module is inserted into the DL850E/DL850EV, it will not comply with safety standard EN61010-1:2010 or EN61010-2-030:2010.

3 The overvoltage category (installation category) is a value used to define the transient overvoltage condition and includes the rated impulse withstand voltage. Category I applies to electric equipment whose power is supplied from a circuit that incorporates withstand voltage control. Category II applies to electrical equipment that is powered through a fixed installation, such as a switchboard.

4 The measurement category of this instrument’s signal input terminals varies depending on the modules that are installed. Use the instrument within the scope of the measurement category that corresponds to the module specifications. Do not use the instrument outside the scope of the measurement category that corresponds to the module specifications. The scope of each measurement category is as follows.
Measurement category Other (O) applies to measurement of circuits that are not directly connected to a main power supply. This category applies to measurement of secondary electric circuits in equipment across a transformer. If the module specifications fall under measurement category O, the estimated transient voltage that may appear at the signal input terminals is 1500 V.
Measurement category II applies to measurement of circuits, such as household electric appliances and portable electric tools, that are connected to low-voltage installations.
Measurement category III applies to measurement of facility circuits, such as distribution boards and circuit breakers.
Measurement category IV applies to measurement of power source circuits, such as entrance cables to buildings and cable systems, for low-voltage installations.

5 Pollution Degree applies to the degree of adhesion of a solid, liquid, or gas which deteriorates withstand voltage or surface resistivity. Pollution degree 2 applies to normal indoor atmospheres (with only non-conductive pollution).

6 TDK: ZCAT2035-0930A, YOKOGAWA part number: A1190MN

7 TDK: ZCAT3035-1330, YOKOGAWA part number: A1179MN

8 TDK: ZCAT1325-0530A, YOKOGAWA part number: A1181MN

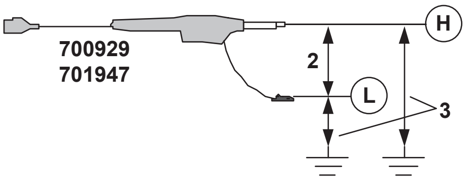
6.13 Module Specifications

High-Speed 10 MS/s, 12-Bit Isolation Module (701250) Specifications

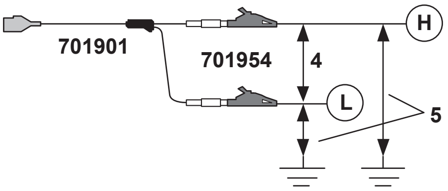
Item	Specifications
Standard operating conditions	Temperature: 23 ±5°C Humidity: 20 to 80% RH After a 30-minute warm-up and after calibration
Effective measurement range	20 div (±10 div around 0 V, display range: 10 div, when Variable is OFF)
Number of input channels	2
Input coupling	AC, DC, and GND
Maximum sample rate	10 MS/s
Input format	Isolated unbalanced
Frequency characteristics[1]	(−3 dB point when sine wave of amplitude ±3 div is applied) DC to 3 MHz
Voltage-axis sensitivity setting	5 mV/div to 20 V/div (1-2-5 steps) (when using 1:1 probe attenuation)
Maximum input voltage (at a frequency of 1 kHz or less)	Combined with the 700929(10:1) or 701947(100:1):[2] 600 V (DC+ACpeak) Combined with the 701901+701954 (1:1):[4] 200 V (DC+ACpeak) (as a value that meets the safety standard) 250 V (DC+ACpeak) (maximum allowable voltage, as a value that does not damage the instrument when applied) Direct input (cable that does not comply with the safety standards):[6] 42 V (DC+ACpeak)
Maximum allowable common mode voltage (at a frequency of 1 kHz or less)	Working voltage of safety standard Combined with the 700929 (10:1) or 701947 (100:1)[3] or combined with the 701901+701954 (1:1):[5] 400 Vrms (measurement category Other (O)), 300 Vrms (CAT II) Direct input (cable that does not comply with the safety standards):[7] 42 V (DC+ACpeak) (CAT II, 30 Vrms)
Vertical (voltage) axis accuracy DC accuracy[1]	5 mV/div to 20 V/div: ±(0.5% of 10 div)
Input connector	BNC connector (isolated type)
Input impedance	1 MΩ ± 1%, approx. 35 pF
−3 dB point when AC coupled low frequency attenuation point	10 Hz or less (1 Hz or less when using the 700929, 0.1 Hz or less when using the 701947)
Common mode rejection ratio	80 dB (50/60 Hz) or more (Typical[8])
Residual noise level (Input section shorted)	±400 μV or ±0.06 div whichever is greater (Typical[8])
Withstand voltage	1500 Vrms for 1 minute (across each terminal and earth) (60 Hz)
Allowable transient surge voltage (instantaneous)	±2100 Vpeak (across each input terminal and earth)
Insulation resistance	500 VDC, 10 MΩ or more (across each input terminal and earth)
A/D conversion resolution	12 bit (150 LSB/div)
Temperature coefficient	Zero point: 5 mV/div to 20 V/div: ±(0.05% of 10 div)/°C(Typical[8]) Gain: ±(0.02% of 10 div)/°C(Typical[8])
Bandwidth limit	Select from OFF, 500 kHz, 50 kHz, 5 kHz, and 500 Hz Cut-off characteristics: −18 dB/OCT (Typical[8])
Probe attenuation setting	Voltage probe: 1:1, 10:1, 100:1, 1000:1 Current probe: 10 A:1 V (for the 700937/701933), 100 A: 1 V (for the 701930/701931)
Compatible probes/cables	Voltage probe: Recommended 700929 (10:1 safety probe).20 to 45 pF: For measuring 600 Vpeak or less 701947 (100:1 probe).15 to 45 pF: For measuring 600 Vpeak or less Current probe (power can be supplied from the DL850E/DL850EV. Option) 700937 (15 A), 701930 (150 A), 701931 (500 A), 701933 (30 A) High voltage differential probe (connect the GND cable provided with the probe to the DL850E/DL850EV case) 700924 (1000:1, 100:1/1400 Vpeak): For measuring 1400 Vpeak or less Connection cable (for high voltage 1:1) 701901 (isolated type BNC-safety alligator clip adapter ×2: For measuring 200 Vpeak or less), 701954 (alligator clip (dolphin type) red/black 2-piece set) is required separately Connection cable (for low voltage 1:1) 366926 (non-isolated type BNC-alligator clip ×2: For measuring low voltage less than or equal to 42 Vpeak)

1 Value measured under standard operating conditions.

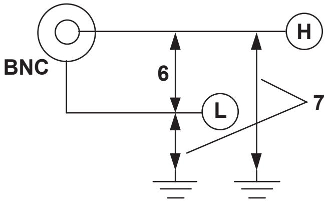
Combined with the 700929 or 701947



Combined with the 701901+701954



Direct input (cable that does not comply with the safety standards)



Withstand voltage: 1500 Vrms for 1 minute
Allowable transient surge voltage: ±2100 Vpeak
(between earth and input)

8 The typical value is a representative or standard value. It is not strictly warranted.

WARNING

- Do not apply input voltage exceeding the maximum input voltage, withstand voltage, or allowable surge voltage.
- To prevent the possibility of electric shock, be sure to furnish protective earth grounding of the DL850E/DL850EV.
- To prevent the possibility of electric shock, be sure to fasten the module screws. Otherwise, the electrical and mechanical protection functions will not be activated.
- Avoid continuous connection under an environment in which the surge voltage may occur.
- To prevent the possibility of electric shock, be sure to connect the GND lead of the differential probe (700924/700925) to the DL850E/DL850EV.

High-Speed High-Resolution 1 MS/s, 16-Bit Isolation Module (701251) Specifications

Item	Specifications
Standard operating conditions	Temperature: 23 ±5°C Humidity: 20 to 80% RH After a 30-minute warm-up and after calibration
Effective measurement range	20 div (±10 div around 0 V, display range: 10 div, when Variable is OFF)
Number of input channels	2
Input coupling	AC, DC, and GND
Maximum sample rate	1 MS/s
Input format	Isolated unbalanced
Frequency characteristics[1] (−3 dB point when a sine wave of amplitude ±3 div is applied)	5 mV/div to 20 V/div: DC to 300 kHz 2 mV/div and 1mV/div: DC to 200 kHz
Voltage-axis sensitivity setting	1 mV/div to 20 V/div (1-2-5 steps) (when using 1:1 probe attenuation)
Maximum input voltage (at a frequency of 1 kHz or less)	Combined with the 700929(10:1) or 701947(100:1):[2] 600 V (DC+ACpeak) Combined with the 701901+701954 (1:1):[4] 140 V (DC+ACpeak) Direct input (cable that does not comply with the safety standards):[6] 42 V (DC+ACpeak)
Maximum allowable common mode voltage (at a frequency of 1 kHz or less)	Working voltage of safety standard Combined with the 700929 (10:1) or 701947 (100:1)[3] or combined with the 701901+701954 (1:1):[5] 400 Vrms (measurement category Other (O)), 300 Vrms (CAT II) Direct input (cable that does not comply with the safety standards):[7] 42 V (DC+ACpeak) (CAT II, 30 Vrms)
Vertical (voltage) axis accuracy DC accuracy[1]	5 mV/div to 20 V/div: ±(0.25% of 10 div) 2 mV/div: ±(0.3% of 10 div) 1 mV/div: ±(0.5% of 10 div)
Input connector	BNC connector (isolated type)
Input impedance	1 MΩ ± 1%, approx. 35 pF
−3 dB point when AC coupled low frequency attenuation point	1 Hz or less (0.1 Hz or less when using the 700929, 0.01 Hz or less when using the 701947)
Common mode rejection ratio	80 dB (50/60 Hz) or more (Typical[8])
Residual noise level (Input section shorted)	±100 μV or ±0.01 div whichever is greater (Typical[8])
Withstand voltage	1500 Vrms for 1 minute (across each terminal and earth) (60 Hz)
Allowable transient surge voltage (instantaneous)	±2100 Vpeak (across each input terminal and earth)
Insulation resistance	500 VDC, 10 MΩ or more (across each input terminal and earth)
A/D conversion resolution	16 bit (2400 LSB/div)
Temperature coefficient	Zero point: 5 mV/div to 20 V/div: ±(0.02% of 10 div)/°C(Typical[8]) 2 mV/div: ±(0.05% of 10 div)/°C(Typical[8]) 1 mV/div: ±(0.10% of 10 div)/°C(Typical[8]) Gain: 1 mV/div to 20 V/div: ±(0.02% of 10 div)/°C(Typical[8])
Bandwidth limit	Select from OFF, 40 kHz, 4 kHz, and 400 Hz Cut-off characteristics: −12 dB/OCT (Typical[8])
Probe attenuation setting	Voltage probe: 1:1, 10:1, 100:1, 1000:1 Current probe: 10 A:1 V (for the 700937/701933), 100 A: 1 V (for the 701930/701931)
Compatible probes/cables	Voltage probe: Recommended 700929 (10:1 safety probe).20 to 45 pF: For measuring 600 Vpeak or less 701947 (100:1 probe).15 to 45 pF: For measuring 600 Vpeak or less Current probe (power can be supplied from the DL850E/DL850EV. Option) 700937 (15 A), 701930 (150 A), 701931 (500 A), 701933 (30 A) High voltage differential probe (connect the GND cable provided with the probe to the DL850E/DL850EV case) 700924 (1000:1, 100:1/1400 Vpeak): For measuring 1400 Vpeak or less Connection cable (for high voltage 1:1) 701901 (isolated type BNC-safety alligator clip adapter ×2: For measuring 200 Vpeak or less), 701954 (alligator clip (dolphin type) red/black 2-piece set) is required separately Connection cable (for low voltage 1:1) 366926 (non-isolated type BNC-alligator clip ×2: For measuring low voltage less than or equal to 42 Vpeak)

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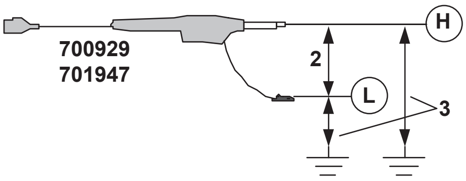
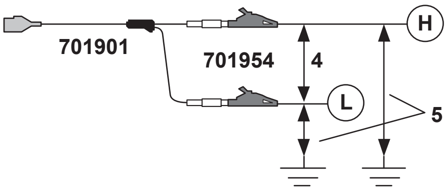
[1] Value measured under standard operating conditions.

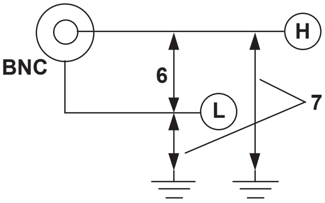
Combined with the 700929 or 701947



Combined with the 701901+701954



Direct input (cable that does not comply with the safety standards)



Withstand voltage: 1500 Vrms for 1 minute
Allowable transient surge voltage: ±2100 Vpeak
(between earth and input)

8 The typical value is a representative or standard value. It is not strictly warranted.

WARNING

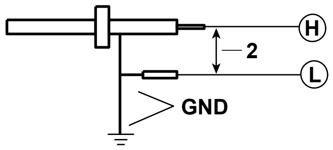
- Do not apply input voltage exceeding the maximum input voltage, withstand voltage, or allowable surge voltage.
- To prevent the possibility of electric shock, be sure to furnish protective earth grounding of the DL850E/DL850EV.
- To prevent the possibility of electric shock, be sure to fasten the module screws. Otherwise, the electrical and mechanical protection functions will not be activated.
- Avoid continuous connection under an environment in which the surge voltage may occur.
- To prevent the possibility of electric shock, be sure to connect the GND lead of the differential probe (700924/700925) to the DL850E/DL850EV.

High-Speed 10 MS/s, 12-Bit Non-Isolation Module (701255) Specifications

Item	Specifications
Standard operating conditions	Temperature: 23 ±5°C Humidity: 20 to 80% RH After a 30-minute warm-up and after calibration
Effective measurement range	20 div (±10 div around 0 V, display range: 10 div, when Variable is OFF)
Number of input channels	2
Input coupling	AC, DC, and GND
Maximum sample rate	10 MS/s
Input format	Non-isolated, unbalanced
Frequency characteristics[1]	(−3 dB point when sine wave of amplitude ±3 div is applied) DC to 3 MHz
Voltage-axis sensitivity setting	5 mV/div to 20 V/div (1-2-5 steps) (when using 1:1 probe attenuation)
Maximum input voltage (at a frequency of 1 kHz or less)	Combined with the 701940(10:1):[2] 600 V (DC+ACpeak)
	Direct input (cable that does not comply with the safety standards):[3] 200 V (DC+ACpeak) (as a value that meets the safety standard) 250 V (DC+ACpeak) (maximum allowable voltage, as a value that does not damage the instrument when applied)
Vertical (voltage) axis accuracy DC accuracy[1]	5 mV/div to 20 V/div: ±(0.5% of 10 div)
Input connector	BNC connector (metallic type)
Input impedance	1 MΩ ± 1%, approx. 35 pF
−3 dB point when AC coupled low frequency attenuation point	10 Hz or less (1 Hz or less when using the 701940)
Residual noise level (Input section shorted)	±400 μV or ±0.06 div whichever is greater (Typical[4])
A/D conversion resolution	12 bit (150 LSB/div)
Temperature coefficient	Zero point: 5 mV/div to 20 V/div: ±(0.05% of 10 div)/°C(Typical[4]) Gain: ±(0.02% of 10 div)/°C(Typical[4])
Bandwidth limit	Select from OFF, 500 kHz, 50 kHz, 5 kHz, and 5400 Hz Cut-off characteristics: −18 dB/OCT (Typical[4])
Probe attenuation setting	Voltage probe: 1:1, 10:1, 100:1, 1000:1 Current probe: 10 A:1 V (for the 700937/701933), 100 A: 1 V (for the 701930/701931)
Compatible probes/cables	Voltage probe (10:1 passive probe): Recommended 701940, 17 to 46 pF: For measuring 600 Vpeak or less Current probe (power can be supplied from the DL850E/DL850EV. Option) 700937 (15 A), 701930 (150 A), 701931 (500 A), 701933 (30 A) High voltage differential probe (connect the GND cable provided with the probe to the DL850E/DL850EV case) 700924 (1000:1, 100:1/1400 Vpeak): For measuring 1400 Vpeak or less Connection cable (for low voltage 1:1) 366926 (non-isolated type BNC-alligator clip ×2: For measuring low voltage less than or equal to 42 Vpeak)

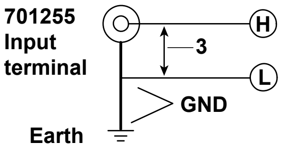
1 Value measured under standard operating conditions.

Recommended:
Combined with the 10:1 passive probe (701940)



GND is connected to the case potential.

Direct input
(cable that does not comply with the safety standards)



GND is connected to the case potential.

4 The typical value is a representative or standard value. It is not strictly warranted.

WARNING

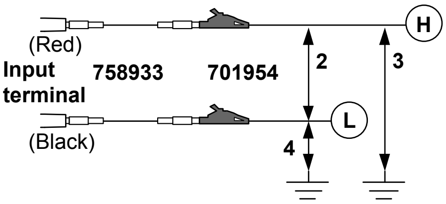
- Do not apply input voltage exceeding the maximum input voltage, withstand voltage, or allowable surge voltage.
- To prevent the possibility of electric shock, be sure to furnish protective earth grounding of the DL850E/DL850EV.
- To prevent the possibility of electric shock, be sure to fasten the module screws.
  The module screws must be fastened for the module to function as a nonisolation module. In addition, all electrical and mechanical protection functions are activated only when the screws are fastened.
- The maximum input voltage of the module is valid only when all the screws are fastened, and the protection path of the metal BNC is secured.

High-Voltage 100 kS/s, 16-Bit Isolation Module (with RMS) (701267) Specifications

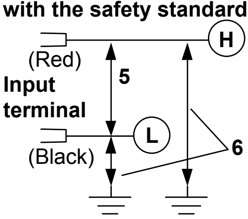
Item	Specifications
Standard operating conditions	Temperature: 23 ±5°C Humidity: 20 to 80% RH After a 30-minute warm-up and after calibration
Effective measurement range	20 div (±10 div around 0 V, display range: 10 div, when Variable is OFF)
Number of input channels	2
Input coupling	AC, DC, GND, AC-RMS, and DC-RMS
Maximum sample rate	100 kS/s
Input format	Isolated unbalanced
Frequency characteristics[1] (−3 dB point when a sine wave of amplitude ±3 div is applied)	Waveform observation mode: DC to 40 kHz RMS observation mode: DC, 40 Hz to 10 kHz
Voltage-axis sensitivity setting	20 mV/div to 200 V/div (1-2-5 steps) (when using 1:1 probe attenuation)
Maximum input voltage (at a frequency of 1 kHz or less)	Combined with the 758933+701954[2] 850 V (DC+ACpeak) Direct input (cable that does not comply with the safety standards):[5] 42 V (DC+ACpeak)
Maximum allowable common mode voltage (at a frequency of 1 kHz or less)	Working voltage of safety standard Combined with the 758933+701954 (across probe tip H and earth[3]): 700 Vrms (CAT II) (across probe tip L and earth[4]): 400 Vrms (CAT II) Direct input (cable that does not comply with the safety standards):[6] 42 V (DC+ACpeak) (CAT II, 30 Vrms) (across the input terminal, H or L, and earth)
Vertical (voltage) axis accuracy DC accuracy[1]	Waveform observation mode DC accuracy ±(0.25% of 10 div) RMS observation mode DC accuracy ±(1.0% of 10 div) AC accuracy (when a sine wave is input) ±(1.5% of 10 div) At frequency of 40 Hz to 1 kH AC accuracy (when the crest factor is 2 or less) ±(2.0% of 10 div) At frequency of 40 Hz to 1 kH AC accuracy (when the crest factor is 3 or less) ±(3.0% of 10 div) At frequency of 40 Hz to 1 kH
Input connector	Plug-in terminal (safety terminal)
Input impedance	1 MΩ ± 1%, approx. 35 pF
−3 dB point when AC coupled low frequency attenuation point	1 Hz or less
Common mode rejection ratio	80 dB (50/60 Hz) or more (Typical[7])
Residual noise level (Input section shorted)	±1 mV or ±0.02 div whichever is greater (Typical[7])
Withstand voltage	3700 Vrms for 1 minute (across each terminal and earth) (60 Hz)
Allowable transient surge voltage (instantaneous)	±5200 Vpeak (across each input terminal and earth)
Insulation resistance	500 VDC, 10 MΩ or more (across each input terminal and earth)
A/D conversion resolution	16 bit (2400 LSB/div)
Temperature coefficient	Zero point: ±(0.02% of 10 div)/°C(Typical[7]) Gain: ±(0.02% of 10 div)/°C(Typical[7])
Response time (only when observing RMS)	Rising (0 to 90% of 10 div): 100 ms (Typical[7]) Falling (100 to 10% of 10 div): 250 ms (Typical[7])
Bandwidth limit	Select from OFF, 10 kHz,1 kHz, and 100 Hz Cut-off characteristics: −12 dB/OCT (Typical[10])
Connection cable	Measurement lead 758933 and alligator clip for measuring 850 V or less (the combination of measurement lead 758933 and alligator clip (dolphin type) is recommended)

1. Value measured under standard operating conditions.

With the 758933 and 701954



Direct input (cable that does not comply with the safety standards)



Withstand voltage: 3700 Vrms for 1 minute
Allowable transient surge voltage (between earth and input): ±5200 Vpeak

7 The typical value is a representative or standard value. It is not strictly warranted.

WARNING

- When measuring high voltages using this module, use a measurement lead 758933 and alligator clip 701954.
- The measurement category of this module when used with 758933 measurement leads and 701954 alligator clips is 400V-CAT II on the low side and 700V-CAT II on the high side. Be careful because the overvoltage tolerance between the low and high sides is different.
- Do not apply input voltage exceeding the maximum input voltage, withstand voltage, or allowable surge voltage.
- To prevent the possibility of electric shock, be sure to furnish protective earth grounding of the DL850E/DL850EV.
- To prevent the possibility of electric shock, be sure to fasten the module screws. Otherwise, the electrical and mechanical protection functions will not be activated.
- Avoid continuous connection under an environment in which the surge voltage may occur.

Universal (Voltage/Temp.) Module (701261) /Universal (Voltage/Temp.) Module (with AAF) (701262) Specifications

<table>
<tr><th>Item</th><th>Specifications</th></tr>
<tr><td>Standard operating conditions</td><td>Temperature: 23 ±5°C
Humidity: 20 to 80% RH
After a 30-minute warm-up and after calibration</td></tr>
<tr><td>Function</td><td>Temperature (thermocouple) or voltage measurement (switchable)</td></tr>
<tr><td>Effective measurement range</td><td>Voltage measurement: 20 div (display range: 10 div)</td></tr>
<tr><td>Number of input channels</td><td>2</td></tr>
<tr><td>Input coupling</td><td>TC, DC, AC, and GND
TC: Temperature (thermocouple) measurement
DC: Voltage measurement (DC coupling)
AC: Voltage measurement (AC coupling)</td></tr>
<tr><td>Voltage measurement maximum sample rate</td><td>100 kS/s</td></tr>
<tr><td>Temperature measurement data update rate</td><td>500 Hz</td></tr>
<tr><td>Input format</td><td>Isolated unbalanced</td></tr>
<tr><td>Measurement range/accuracy[1]

Thermocouple standards
• K, E, J, T, N, R, S, B:
IEC584-1 (1995)
DIN IEC584
JIS C1602 - 1995
• W: W-5%/Re/W-26%/Re
(Hoskins Mfg. Co.)
ASTM E988
• L: Fe-CuNi, DIN43710
• U: Cu-CuNi, DIN43710</td><td>[Voltage measurement] Voltage sensitivity: 5 mV/div to 20 V/div (1-2-5 steps)
Voltage accuracy: ±(0.25% of 10 div)
[Temperature measurement][2]
<table>
<tr><th>Type</th><th>Measurement Range</th><th>Accuracy</th></tr>
<tr><td>K</td><td>−200 to 1300°C</td><td>±(0.1% of reading + 1.5°C)
Except ±(0.2% of reading + 1.5°C)
for −200°C to 0°C</td></tr>
<tr><td>E</td><td>−200 to 800°C</td><td></td></tr>
<tr><td>J</td><td>−200 to 1100°C</td><td></td></tr>
<tr><td>T</td><td>−200 to 400°C</td><td></td></tr>
<tr><td>L</td><td>−200 to 900°C</td><td></td></tr>
<tr><td>U</td><td>−200 to 400°C</td><td></td></tr>
<tr><td>N</td><td>0 to 1300°C</td><td></td></tr>
<tr><td>R</td><td>0 to 1700°C</td><td>±(0.1% of reading + 3°C)
Except, 0 to 200°C: ±8°C
200 to 800°C: ±5°C</td></tr>
<tr><td>S</td><td>0 to 1700°C</td><td></td></tr>
<tr><td>B</td><td>0 to 1800°C</td><td>±(0.1% of reading + 2°C)
Except, 400 to 700°C: ±8°C
Effective range is 400 to 1800°C</td></tr>
<tr><td>W</td><td>0 to 2300°C</td><td>±(0.1% of reading + 3°C)</td></tr>
<tr><td>Au7Fe[3]</td><td>0 to 300K</td><td>0 to 50K: ±4K
50 to 300K: ±2.5K</td></tr>
</table></td></tr>
<tr><td>Frequency characteristics[1]
(−3 dB point when a sine wave of amplitude ±3 div is applied)</td><td>[Voltage measurement] DC to 40 kHz
[Temperature measurement] DC to 100 Hz</td></tr>
<tr><td>Maximum input voltage[4]
(at a frequency of 1 kHz or less)</td><td>Both temperature and voltage input: 42 V (DC + ACpeak) (as a value that meets the safety standard)
150 V (DC + ACpeak) (maximum allowable voltage, as a value that does not damage the instrument when applied)</td></tr>
<tr><td>Maximum allowable common mode voltage[5]
(at a frequency of 1 kHz or less)</td><td>Both temperature and voltage input: 42 V (DC+ACpeak) (CAT II, 30 Vrms)</td></tr>
<tr><td>Vertical resolution</td><td>[Voltage measurement] During voltage input: 2400 LSB/div
[Temperature measurement] When measuring temperature: 0.1°C</td></tr>
<tr><td>−3 dB point when AC coupled low frequency attenuation point</td><td>[Voltage measurement] 0.5 Hz or less</td></tr>
<tr><td>Input connector</td><td>Binding post</td></tr>
<tr><td>Input impedance</td><td>Approx. 1 MΩ</td></tr>
<tr><td>Common mode rejection ratio</td><td>[Voltage measurement] 80 dB (50/60 Hz) or more (Typical[6])
[Temperature measurement] 120 dB or more (50/60 Hz, with 2-Hz filter ON, signal source resistance of 500 Ω or less) (Typical[6])</td></tr>
<tr><td>Residual noise level
(Input section shorted)</td><td>[Voltage measurement] ±100 μV or ±0.01 div, whichever is greater (Typical[6])</td></tr>
<tr><td>A/D conversion resolution</td><td>[Voltage measurement] 16 bits (2400 LSB/div)</td></tr>
</table>

6.13 Module Specifications

<table>
<tr><th>Item</th><th>Specifications</th></tr>
<tr><td>Temperature coefficient</td><td>[Voltage measurement] Zero point: ±(0.01% of 10 div)/°C (Typical[6])
Gain: ±(0.02% of 10 div)/°C (Typical[6])</td></tr>
<tr><td>Reference junction compensation accuracy (when the input terminal temperature is balanced)</td><td>K, E, J, T, L, U, N: ±1°C
R, S, B, W: ±1.5°C
Au7Fe: ±1K</td></tr>
<tr><td>Bandwidth limit</td><td>[Temperature measurement] (Digital filter + analog filter)
Select from OFF, 30 Hz, 8 Hz, and 2 Hz + 150 Hz secondary analog filter
[Voltage measurement] Select from OFF, AUTO, 4 kHz, 400 Hz, or 40 Hz.
Cutoff characteristics: −12 dB/OCT (Typical,[6] setting other than AUTO)
Cutoff frequency (fc) when set to AUTO (701262 only)
<table>
<tr><th>Sample Rate</th><th>Cutoff Frequency (fc)</th></tr>
<tr><td>100 kS/s or higher</td><td>40 kHz</td></tr>
<tr><td>100 S/s to 50 kS/s</td><td>40% of the sample rate</td></tr>
<tr><td>50 S/s or less</td><td>20 Hz</td></tr>
</table>
Cutoff characteristics for AUTO: −65 dB at 2 × fc (Typical[6])</td></tr>
<tr><td>Table of cutoff frequency characteristics of the anti-aliasing filter (AAF)</td><td>When the filter is set to Auto, the anti-aliasing filter and low-pass filter are automatically set according to the sample rate.
<table>
<tr><th>Sample Rate</th><th>AAF</th><th>Low-Pass Filter</th></tr>
<tr><td>100 kS/s</td><td>40 kHz</td><td>OFF</td></tr>
<tr><td>50 kS/s</td><td>20 kHz</td><td>OFF</td></tr>
<tr><td>20 kS/s</td><td>8 kHz</td><td>OFF</td></tr>
<tr><td>10 kS/s</td><td>4 kHz</td><td>4 kHz</td></tr>
<tr><td>5 kS/s</td><td>2 kHz</td><td>4 kHz</td></tr>
<tr><td>2 kS/s</td><td>800 Hz</td><td>4 kHz</td></tr>
<tr><td>1 kS/s</td><td>400 Hz</td><td>400 Hz</td></tr>
<tr><td>500 S/s</td><td>200 Hz</td><td>400 Hz</td></tr>
<tr><td>200 S/s</td><td>80 Hz</td><td>400 Hz</td></tr>
<tr><td>100 S/s</td><td>40 Hz</td><td>40 Hz</td></tr>
<tr><td>50 S/s</td><td>20 Hz</td><td>40 Hz</td></tr>
<tr><td>20 S/s to 5 S/s</td><td>20 Hz</td><td>40 Hz</td></tr>
<tr><td>2 S/s or less</td><td>20 Hz</td><td>40 Hz</td></tr>
<tr><td>Ext sample</td><td>40 kHz</td><td>OFF</td></tr>
</table></td></tr>
</table>

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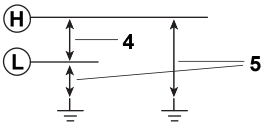
1 Value measured under standard operating conditions (section 19.11).

2 Does not include the reference junction temperature compensation accuracy.

3 This module supports Au7Fe with 0.07% metal content with respect to gold.



6. Typical value represents a typical or average value. It is not strictly warranted.

WARNING

- Do not apply input voltage exceeding the maximum input voltage or allowable common mode input voltage.
- To prevent the possibility of electric shock, be sure to furnish protective earth grounding of the DL850E/DL850EV.
- To prevent the possibility of electric shock, be sure to fasten the module screws. Otherwise, the electrical and mechanical protection functions will not be activated.

Temperature, High Precision Voltage Isolation Module (701265) Specifications

Item	Specifications
Standard operating conditions	Temperature: 23 ±5°C Humidity: 20 to 80% RH After a 30-minute warm-up and after calibration
Function	Temperature (thermocouple) or voltage measurement (switchable)
Effective measurement range	Voltage measurement: 20 div (display range: 10 div)
Number of input channels	2
Input coupling	TC, DC, and GND TC: Temperature (thermocouple) measurement DC: Voltage measurement (DC coupling)
Data update rate	500 Hz
Measurement range/accuracy[1] For the thermocouple standards, see the 701261 specifications.	[Voltage measurement] Voltage sensitivity: 100 µV/div to 10 V/div (1-2-5 steps) Voltage accuracy: ±(0.08% of 10 div + 2 µV) [Temperature measurement][2]

Type	Measurement Range	Accuracy
K	−200 to 1300°C	±(0.1% of reading + 1.5°C) Except ±(0.2% of reading + 1.5°C) for −200°C to 0°C
E	−200 to 800°C	
J	−200 to 1100°C	
T	−200 to 400°C	
L	−200 to 900°C	
U	−200 to 400°C	
N	0 to 1300°C	
R	0 to 1700°C	±(0.1% of reading + 3°C) Except, 0 to 200°C: ±8°C 200 to 800°C: ±5°C
S	0 to 1700°C	
B	0 to 1800°C	±(0.1% of reading + 2°C) Except, 400 to 700°C: ±8°C Effective range is 400 to 1800°C
W	0 to 2300°C	±(0.1% of reading + 3°C)
Au7Fe[3]	0 to 300K	0 to 50K: ±4K 50 to 300K: ±2.5K

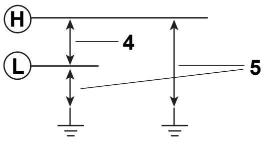
Frequency characteristics[1] (−3 dB point when a sine wave of amplitude ±3 div is applied)	[Voltage measurement] DC to 100 Hz [Temperature measurement] DC to 100 Hz
Maximum input voltage[4] (at a frequency of 1 kHz or less)	Both temperature and voltage input: 42 V (DC + ACpeak)
Maximum allowable common mode voltage[5] (at a frequency of 1 kHz or less)	Both temperature and voltage input: 42 V (DC+ACpeak) (CAT II, 30 Vrms)
Vertical resolution	[Voltage measurement] During voltage input: 2400 LSB/div [Temperature measurement] When measuring temperature: 0.1°C
−3 dB point when AC coupled low frequency attenuation point	[Voltage measurement] 0.5 Hz or less
Input connector	Binding post
Input impedance	Approx. 1 MΩ
Common mode rejection ratio	[Voltage measurement] 80 dB (50/60 Hz) or more (Typical[6]) [Temperature measurement] 120 dB or more (50/60 Hz, with 2-Hz filter ON, signal source resistance of 500 Ω or less) (Typical[6])
Residual noise level (Input section shorted)	[Voltage measurement] ±4 µV or ±0.01 div, whichever is greater (Typical[6])
A/D conversion resolution	[Voltage measurement] 16 bits (2400 LSB/div)
Temperature coefficient	[Voltage measurement] Zero point: ±(0.01% of 10 div)/°C + 0.05µV/°C) (Typical[6]) Gain ±(0.02% of 10 div)/°C (Typical[6])
Reference junction compensation accuracy (when the input terminal temperature is balanced)	K, E, J, T, L, U, N: ±1°C R, S, B, W: ±1.5°C Au7Fe: ±1K
Bandwidth limit (digital filter)	Select from OFF, 30 Hz, 8 Hz, and 2 Hz

Item	Specifications
Input bias current	20 nA or less The zero point appears to be offset when the input is open due to the effects of bias current on this module. However, this is not a malfunction. Connect the input to the object to be measured.

1 Value measured under standard operating conditions.

2 Does not include the reference junction temperature compensation accuracy.

3 This module supports Au7Fe with 0.07% metal content with respect to gold.



6 The typical value is a representative or standard value. It is not strictly warranted.

WARNING

- Do not apply input voltage exceeding the maximum input voltage or allowable common mode input voltage.
- To prevent the possibility of electric shock, be sure to furnish protective earth grounding of the DL850E/DL850EV.
- To prevent the possibility of electric shock, be sure to fasten the module screws. Otherwise, the electrical and mechanical protection functions will not be activated.

Strain Module (NDIS) (701270) Specifications

Item	Specifications
Standard operating conditions	Temperature: 23 ±5°C Humidity: 20 to 80% RH After a 30-minute warm-up and after calibration and auto balance
Effective measurementrange	−FS to +FS (set using upper and lower limits)
Number of input channels	2
Maximum sample rate	100 kS/s
Input format	DC bridge (auto balancing), balanced differential input, and isolated
Auto balance type	Electronic auto balance
Auto balance range	±10000 μSTR (1 gauge method)
Bridge voltage	Select from 2 V, 5 V, and 10 V.
Gauge resistance	120 Ω to 1000 Ω (bridge voltage: 2 V) 350 Ω to 1000 Ω (bridge voltage: 2 V, 5 V, and 10 V)
Gauge factor	1.90 to 2.20 (set in 0.01 steps)
Frequency characteristics[1] (−3 dB point when a sine wave of amplitude ±3 div is applied)	DC to 20 kHz
mV/V range support	Supports the strain gauge transducer unit system. mV/V range = 0.5×(μSTR range/1000)
Measurement range (FS) and measurement range	When using STR range

Measurement Range (FS)	Measurement Range
500 μSTR	−500 μSTR to +500 μSTR
1000 μSTR	−1000 μSTR to +1000 μSTR
2000 μSTR	−2000 μSTR to +2000 μSTR
5000 μSTR	−5000 μSTR to +5000 μSTR
10000 μSTR	−10000 μSTR to +10000 μSTR
20000 μSTR	−20000 μSTR to +20000 μSTR

When using mV/V range

Measurement Range (FS)	Measurement Range
0.25 mv/V	−0.25 mV/V to +0.25 mV/V
0.5 mV/V	−0.5 mV/V to +0.5 mV/V
1 mV/V	−1 mV/V to +1 mV/V
2.5 mV/V	−2.5 mV/V to +2.5 mV/V
5 mV/V	−5 mV/V to +5 mV/V
10 mV/V	−10 mV/V to +10 mV/V

Item	Specifications	
DC accuracy[1]	±(0.5% of FS + 5 μSTR)	
Maximum input voltage (at a frequency of 1 kHz or less)	Between Input+ and Input−	10 V (DC+ACpeak)
Maximum allowable common mode voltage (at a frequency of 1 kHz or less)	Between each terminal and earth ground	42 V (DC+ACpeak) (CAT II, 30 Vrms)
Input connector	NDIS connector (Recommended by JSNDI (The Japanese Society for Non-destructive Inspection)	
Common mode rejection ratio	80 dB (50/60 Hz) or more (Typical[2])	
A/D conversion resolution	16 bit (4800 LSB/div: Upper = +FS, Lower = −FS)	
Temperature coe	Zero point: ±5 μSTR/°C(Typical[2]) Gain: ±(0.02% of FS)/°C (Typical[2])	
Bandwidth limit	Select from OFF, 1 kHz, 100 Hz, and 10 Hz Cutoff characteristics: −12 dB/OCT (Typical[2])	
Function	mV/V support. Supports the strain gauge transducer unit system.	
Standard accessories	NDIS connector (for external connection: PRC03-12A10-7M10.5 by Tajimi) A1002JC: 2 pieces	
Compatible accessories (sold separately)	Recommended bridge head 701955 (NDIS 120 Ω, enhanced shield version, comes with a 5-m cable) Recommended bridge head 701956 (NDIS 350 Ω, enhanced shield version, comes with a 5-m cable))	

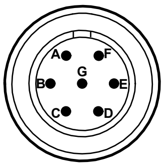
6.13 Module Specifications

Item	Specifications
Precautions	• Highly sensitive measurements are made in the μV level in strain measurements. Therefore, take measures against noise at the strain sensor perimeter, bridge head, and cable wiring. • Depending on the noise environment, an error may result in the balance. Check the influence before making measurements. • The bridge head specified by YOKOGAWA has high noise resistance. • Some of the strain gauge sensors and bridge heads made by other manufacturers do not have sensing wires connected. (No such problems with bridge heads made by YOKOGAWA.) If such products are used, an error may result in the bridge voltage leading to measurement errors, because sensing does not work effectively. If possible, it is desirable that sensing be done very close to the bridge. However, if this is not possible, use the NDIS conversion cable (DV450-001) that is sold separately by YOKOGAWA. Outline specifications of the DV450-001: Sensing cable, NDIS male-female, 30 cm in length, insert it as close to the bridge as possible • The connector shell is connected to the case potential. • When a bridge head (701955 or 701956) is used, the connector shell, cable shield, and the bridge head case are all connected to the case potential of the DL850E/DL850EV. • When a bridge head (701955 or 701956) is used, the floating GND is connected to the bridge head case inside the bridge head. • Be sure to execute balancing again when you change the range or the bridge voltage.

1 Value measured under standard operating conditions.

2 The typical value is a representative or standard value. It is not strictly warranted.

Module front View



A: Bridge+ (positive bridge voltage)
B: Input- (negative measurement signal)
C: Bridge- (negative bridge voltage)
D: Input+ (positive measurement signal)
E: Floating common
F: Sense+ (positive bridge voltage sensing)
G: Sense- (positive bridge voltage sensing)

The connector shell is connected to the case potential.

WARNING

- Do not apply input voltage exceeding the maximum input voltage or allowable common mode input voltage.
- To prevent the possibility of electric shock, be sure to furnish protective earth grounding of the DL850E/DL850EV.
- To prevent the possibility of electric shock, be sure to fasten the module screws. Otherwise, the electrical and mechanical protection functions will not be activated.
- Avoid continuous connection under an environment in which the surge voltage may occur.

Strain Module (DSUB, Shunt-Cal) (701271) Specifications

Item	Specifications
Standard operating conditions	Temperature: 23 ±5°C Humidity: 20 to 80% RH After a 30-minute warm-up and after calibration and auto balance
Effective measurementrange	−FS to +FS (set using upper and lower limits)
Number of input channels	2
Maximum sample rate	100 kS/s
Input format	DC bridge (auto balancing), balanced differential input, and isolated
Auto balance type	Electronic auto balance
Auto balance range	±10000 μSTR (1 gauge method)
Bridge voltage	Select from 2 V, 5 V, and 10 V.
Gauge resistance	120 Ω to 1000 Ω (bridge voltage: 2 V) 350 Ω to 1000 Ω (bridge voltage: 2 V, 5 V, and 10 V)
Gauge factor	1.90 to 2.20 (set in 0.01 steps)
Frequency characteristics[1] (−3 dB point when a sine wave of amplitude ±3 div is applied)	DC to 20 kHz
mV/V range support	Supports the strain gauge transducer unit system. mV/V range = 0.5×(μSTR range/1000)
Measurement range (FS) and measurement range	When using STR range

Measurement Range (FS)	Measurement Range
500 μSTR	−500 μSTR to +500 μSTR
1000 μSTR	−1000 μSTR to +1000 μSTR
2000 μSTR	−2000 μSTR to +2000 μSTR
5000 μSTR	−5000 μSTR to +5000 μSTR
10000 μSTR	−10000 μSTR to +10000 μSTR
20000 μSTR	−20000 μSTR to +20000 μSTR

When using mV/V range

Measurement Range (FS)	Measurement Range
0.25 mv/V	−0.25 mV/V to +0.25 mV/V
0.5 mV/V	−0.5 mV/V to +0.5 mV/V
1 mV/V	−1 mV/V to +1 mV/V
2.5 mV/V	−2.5 mV/V to +2.5 mV/V
5 mV/V	−5 mV/V to +5 mV/V
10 mV/V	−10 mV/V to +10 mV/V

DC accuracy[1]	±(0.5% of FS+5 μSTR)	
Maximum input voltage (at a frequency of 1 kHz or less)	Between Input+ and Input−	10 V (DC+ACpeak)
Maximum allowable common mode voltage (at a frequency of 1 kHz or less)	Between each terminal and earth ground	42 V (DC+ACpeak) (CAT II, 30 Vrms)
Input connector	9-pin D-Sub connector (female)	
Common mode rejection ratio	80 dB (50/60 Hz) or more (Typical[2])	
A/D conversion resolution	16 bit (4800 LSB/div: Upper = +FS, Lower = −FS)	
Temperature coe	Zero point: ±5 μSTR/°C(Typical[2]) Gain: ±(0.02% of FS)/°C (Typical[2])	
Bandwidth limit	Select from OFF, 1 kHz, 100 Hz, and 10 Hz Cutoff characteristics: −12 dB/OCT (Typical[2])	
Function	mV/V support. Supports the strain gauge transducer unit system. Shunt calibration support. Built-in shunt calibration relay (1 gauge method).	
Standard accessories	Connector shell set for soldering A1520JD (9-pin D-Sub): 2 pieces, A1618JD (connector shell): 2 pieces	
Compatible accessories (sold separately)	Recommended bridge head 701957 (D-Sub 120 Ω, shunt-Cal, comes with a 5-m cable) Recommended bridge head 701958 (D-Sub 350 Ω, shunt-Cal, comes with a 5-m cable)	

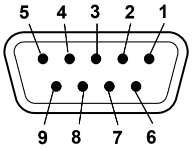
6.13 Module Specifications

Item	Specifications
Precautions	• Highly sensitive measurements are made in the μ V level in strain measurements. Therefore, take measures against noise at the strain sensor perimeter, bridge head, and cable wiring. • Depending on the noise environment, an error may result in the balance. Check the influence before making measurements. • The bridge head specified by YOKOGAWA has high noise resistance. • When executing shunt calibration, be sure to calculate the shunt resistance in advance, and execute it in a range so that the measured values do not exceed the range even when the shunt resistance is ON. • Some of the strain gauge sensors and bridge heads made by other manufacturers do not have sensing wires connected. (No such problems with bridge heads made by YOKOGAWA.) If such products are used, an error may result in the bridge voltage leading to measurement errors, because sensing does not work effectively. Perform sensing as close to the bridge head as possible. (There is no conversion cable for sensing on D-Sub connector types.) • The connector shell is connected to the case potential. • When a bridge head (701957 or 701958) is used, the connector shell, cable shield, and the bridge head case are all connected to the case potential of the DL850E/DL850EV. • When a bridge head (701957 or 701958) is used, the floating GND is connected to the bridge head case inside the bridge head. • Be sure to execute balancing again when you change the range or the bridge voltage.

1 Value measured under standard operating conditions.

2 The typical value is a representative or standard value. It is not strictly warranted.

Module front View



1: Floating common
2: Sense- (positive bridge voltage sensing)
3: Shuntcal- (negative shunt signal)
4: Shuntcal+ (positive shunt signal)
5: Sense+ (positive bridge voltage sensing)
6: Bridge- (negative bridge voltage)
7: Input- (negative measurement signal)
8: Input+ (positive measurement signal)
9: Bridge+ (positive bridge voltage)

WARNING

- Do not apply input voltage exceeding the maximum input voltage or allowable common mode input voltage.
- To prevent the possibility of electric shock, be sure to furnish protective earth grounding of the DL850E/DL850EV.
- To prevent the possibility of electric shock, be sure to fasten the module screws. Otherwise, the electrical and mechanical protection functions will not be activated.
- Avoid continuous connection under an environment in which the surge voltage may occur.

Acceleration/Voltage Module (with AAF) (701275) Specifications

Item	Specifications
Standard operating conditions	Temperature: 23 ±5°C Humidity: 20 to 80% RH After a 30-minute warm-up and after calibration
Effective measurement range	20 div (display range: 10 div)
Number of input channels	2
Input coupling	AC, DC, GND, ACCL (acceleration), and GND
Maximum sample rate	100 kS/s
Input format	Isolated unbalanced
Frequency characteristics[1] (−3 dB point when a sine wave of amplitude ±3 div is applied)	Waveform observation mode: DC to 40 kHz Acceleration measurement mode: 0.4 Hz to 40 kHz
Voltage-axis sensitivity setting	5 mV/div to 10 V/div (1-2-5 steps) (when using 1:1 probe attenuation) Acceleration (±5 V = ×1 range): ×0.1 to ×1 to ×100 (in 1-2-5 steps)
Maximum input voltage (at a frequency of 1 kHz or less)	42 V (DC+Acpeak)[2]
Maximum allowable common mode voltage (at a frequency of 1 kHz or less)	Working voltage of safety standard 42 V (DC+ACpeak) (CAT II, 30 Vrms)[3]
Vertical (voltage) axis accuracy DC accuracy[1]	Waveform measurement mode DC accuracy: ±(0.25% of 10 div) Acceleration measurement mode: ±(0.5% of 10 div) at 1 kHz
Input connector	Metal BNC connector
Input impedance	1 MΩ±1%, approx. 35 pF
−3 dB point when AC coupled low frequency attenuation point	0.4 Hz or less (0.04 Hz or less when using the 701940) (Typical[4])
Common mode rejection ratio	80 dB (50/60 Hz) or more (Typical[4])
Residual noise level (Input section shorted)	±100 μV or ±0.01 div, whichever is greater (Typical[4])
A/D conversion resolution	16 bits (2400LSB/div)
Temperature coefficient	When in waveform measurement mode (excluding AUTO filter) Zero point: ±(0.02% of 10 div)/°C (Typical[4]) Gain: ±(0.02% of 10 div)/°C (Typical[4])
Response time (only when observing RMS)	Select from OFF, Auto, 4 KHz, 400 Hz, and 40 Hz Cutoff characteristics: −12 dB/OCT (Typical[4], excluding AUTO) Cutoff frequency (fc) when set to AUTO Sample rate of 100 kHz or higher: fc = 40 kHz Sample rate of 100 Hz to 50 kHz: fc = 40% of the sampling rate Sample rate of 50 Hz or less: fc = 20 Hz Cutoff characteristics when set to AUTO: −65 dB at 2×fc (Typical[4])
Bandwidth limit	Voltage probe 1:1, 10:1, 100:1, or 1000:1 Current probe 10 A:1 V (for the 700937/701933), 100 A:1 V (for the 701930/701931)
Probe attenuation setting	Connection cable (for low voltage 1:1) 366926 (non-isolated type BNC-alligator clip × 2: For measuring low voltage less than or equal to 42 Vpeak) Voltage probe (10:1 passive probe) 701940 17 to 46 pF: For measuring 600 V (DC+ACpeak) or less Current probe (power can be supplied from the DL850E/DL850EV) 700937 (15 A), 701930 (150 A), 701931 (500 A), 701933 (30 A)
Sensor supply current (voltage)	OFF/4 mA ± 10%(approx. 22 VDC)
Applicable acceleration sensor	Built-in amplifier type Kistler Instrument Corporation: Piezotron, PCB Piezotronics Incorporated: ICP, ENDEVCO Corporation: ISOTRON, etc.

Item	Specifications
Table of Cutoff Frequency Characteristics of the Anti-Aliasing Filter (AAF)	When the filter is set to Auto, the anti-aliasing filter and low-pass filter are automatically set according to the sample rate.

Sample Rate	AAF	Low-pass filter
100 kS/s	40 kHz	OFF
50 kS/s	20 kHz	OFF
20 kS/s	8 kHz	OFF
10 kS/s	4 kHz	4 kHz
5 kS/s	2 kHz	4 kHz
2 kS/s	800 Hz	4 kHz
1 kS/s	400 Hz	400 Hz
500 S/s	200 Hz	400 Hz
200 S/s	80 Hz	400 Hz
100 S/s	40 Hz	40 Hz
50 S/s	20 Hz	40 Hz
20 S/s to 5 S/s	20 Hz	40 Hz
2 S/s or less	20 Hz	40 Hz
Ext sample	40 kHz	OFF

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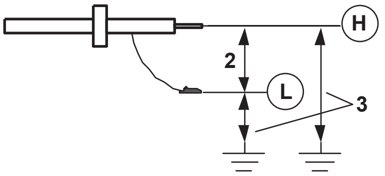
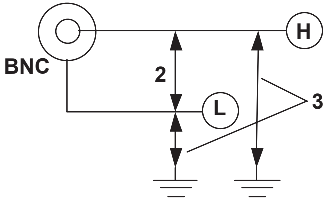
1 Value measured under standard operating conditions.

Combined with the 10:1 passive probe (701940)



Direct input (cable that does not comply with the safety standards)



4 The typical value is a representative or standard value. It is not strictly warranted.

WARNING

- Do not apply input voltage exceeding the maximum input voltage or allowable common mode input voltage.
- To prevent the possibility of electric shock, be sure to furnish protective earth grounding of the DL850E/DL850EV.
- To prevent the possibility of electric shock, be sure to fasten the module screws. Otherwise, the electrical and mechanical protection functions will not be activated.
- Avoid continuous connection under an environment in which the surge voltage may occur.

Frequency Module (701280) Specifications

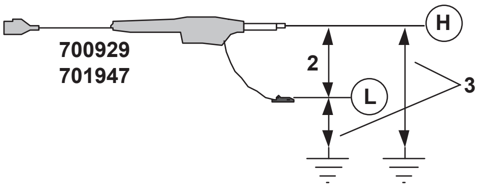
Item	Specifications
Standard operating conditions	Temperature: 23 ±5°C Humidity: 20 to 80% RH After a 30-minute warm-up and after calibration
Measurement function	Frequency, RPMs, RPSs, period, duty cycle, power supply frequency, pulse width, pulse integration, and velocity
Effective measurement range	20 div (display range: 10 div)
Number of input channels	2
Data update rate	25 kHz (40 μs)
Output delay time	Up to 2 computation periods
Input format	Isolated unbalanced
Input connector	Metal BNC connector
Maximum input voltage	Combined with the 700929(10:1) or 701947(100:1):[2] 420 V (DC+ACpeak) Combined with the (701901 + 701954) (1:1) or direct input (cable that does not comply with the safety standards):[4] 42 V (DC+ACpeak)
Maximum allowable common mode voltage	Working voltage of safety standard Combined with the 700929(10:1) or 701947(100:1):[3] 300 Vrms (CAT II) Combined with the (701901 + 701954) (1:1) or direct input (cable that does not comply with the safety standards):[5] 42 V (DC+ACpeak) (CAT II, 30 Vrms)
Insulation resistance	500 VDC, 10 MΩ or more (across each input terminal and earth)
Minimum measurement resolution	50 ns
Measured data resolution	16 bits (2400 LSB/div)

Item	Specifications
Measurement accuracy[1]	**• When in frequency, RPM, RPS, or velocity measurement mode[6]** Measurement accuracy is specified according to the measurement range and input frequency [Definition of measurement accuracy] v±(0.05% of 10 div + accuracy dependent on the input frequency) [Accuracy dependent on the input frequency] When input frequency is 2 kHz or less: 0.05% of the input frequency + 0.001 Hz Input frequency of 2 kHz to 10 kHz: 0.1% of the input frequency Input frequency of 10 kHz to 20 kHz: 0.3% of the input frequency Input frequency of 20 kHz or higher: 0.5% of the input frequency **• When in power supply frequency mode[7]** When the center frequency is 50/60 Hz: ±0.03 Hz (0.01 Hz resolution) When the center frequency is 400 Hz: ±0.3 Hz (0.01 Hz resolution) (Input set to AC100 V or AC200 V with sine wave input) **• When in period measurement mode[6]** Measurement accuracy is specified according to the measurement range and input period [Definition of measurement accuracy] ±(0.05% of 10 div + accuracy dependent on the input period) [Accuracy dependent on the input period] Input period of 500 μs or greater: 0.05% of the input period Input period of 100 μs to 500 μs: 0.1% of the input period Input period of 50 μs to 100 μs: 0.3% of the input period Input period of 50 μs or less: 0.5% of the input period + 0.1 μs **• When in duty cycle measurement mode[8]** Dependent on the input frequency Input frequency of 1 kHz or less: ±0.1% Input frequency of 1 kHz to 10 kHz: ±0.2% Input frequency of 10 kHz to 50 kHz: ±1.0% Input frequency of 50 kHz to 100 kHz: ±2.0% Input frequency of 100 kHz to 200 kHz: ±4.0% **• When in pulse width measurement mode[8]** Measurement accuracy is specified according to the measurement range and input pulse width [Definition of measurement accuracy] ±(0.05% of 10 div + accuracy dependent on the input pulse width) [Accuracy dependent on the input pulse width] Input pulse width of 500 μs or greater: 0.05% of the input pulse width Input pulse width of 100 μs to 500 μs: 0.1% of the input pulse width Input pulse width of 50 μs to 100 μs: 0.3% of the input pulse width Input pulse width of 50 μs or less: 0.5% of the input pulse width + 0.1 μs
Input voltage range (±FS)	When using 1:1 probe attenuation: ±1 V, ±2 V, ±5 V, ±10 V, ±20 V, ±50 V (±FS)
Input impedance	1 MΩ ± 1 approx. 35 pF Pull-up function: 4.7 kΩ, approx. 5 V (pull-up can be turned ON only when the input is set to Pull-Up 5 V)
Input coupling settings	AC, DC
Probe attenuation setting	10:1, 1:1
Minimum voltage width for pulse detection	200 $\text{mV}_{\text{P-P}}$
Bandwidth limit	Select from Full, 100 kHz, 10 kHz, 1 kHz, and 100 Hz Cutoff characteristics: −12 dB/OCT (Typical[9])
Threshold	Set within the FS of the voltage range. Set in units of 1% of the FS.
Hysteresis	Select ±1%, ±2.5%, or ±5% of the FS of the voltage range
Preset function	Logic (5 V/3 V/12 V/24 V), electromagnetic pickup, zero crossing, pull-up, AC100 V, AC200 V, and user-defined
Slope selection	Select rising or falling
Lower −3 dB point when AC coupled	0.5 Hz or less (0.05 Hz or less when using the 700929, 0.005 Hz or less when using the 701947) (Typical[9])
Chatter elimination function	OFF or 1 to 1000 ms (1 ms resolution) Eliminates the chatter that occurs such when the contact input is turned ON/OFF. Can discard the signal changes over the specified interval.
Input status indication function	Input status indication through the LEDs of each channel function When in operation: Illuminates in green when pulse input is detected When overdriven: Illuminates in red when the input voltage exceeds the range

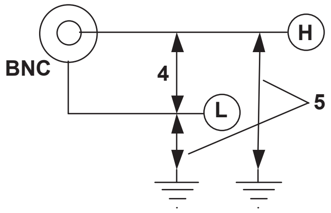
Item	Specifications
Compatible probes/cables	Connection cable (1:1): Recommended 1 366926 Voltage probe: Recommended 2 700929 (10:1 safety probe) .20 to 45 pF: For measuring 1000 V (DC+ACpeak) or less 701947 (100:1 probe) .15 to 45 pF: For measuring 1000 V (DC+ACpeak) or less

1 Value measured under standard operating conditions.

Combined with the 700929 or 701947



Combined with the (701901 + 701954) or direct input (cable that does not comply with the safety standards)



Withstand voltage: 1500 Vrms for 1 minute
Allowable transient surge voltage (between earth and input): ±2100 Vpeak

6 Input waveform of 1 Vpp, rectangular wave, rise/fall time within 1 ms (input range: ±10 V, bandwidth limit: Full, and hysteresis: ±1%)
7 Input waveform of 90 Vrms, sine wave (input range: AC100 V, bandwidth limit 100 kHz, and hysteresis: ±1%)
8 Input waveform of 1 Vpp, rectangular wave, rise/fall time within 5 ns (input range: ±10 V, bandwidth limit: Full, and hysteresis: ±1%)
9 Typical value represents a typical or average value. It is not strictly warranted.

WARNING

- Do not apply input voltage exceeding the maximum input voltage or allowable common mode input voltage.
- To prevent the possibility of electric shock, be sure to furnish protective earth grounding of the DL850E/DL850EV.
- To prevent the possibility of electric shock, be sure to fasten the module screws. Otherwise, the electrical and mechanical protection functions will not be activated.
- Avoid continuous connection under an environment in which the surge voltage may occur.

Specifications by Measurement Modes

Item	Specifications
Frequency	
Measurable frequency range	0.01 Hz to 200 kHz
Selectable vertical axis sensitivity	0.1 Hz/div to 50 kHz/div (1-2-5 steps)
Minimum resolution	0.001 Hz
RPMs	
Measurable RPMs range	0.01 rpm to 100000 rpm (where the input frequency is DC to 200 kHz).
Selectable vertical axis sensitivity	0.1 rpm/div to 10 krpm/div (1-2-5 steps)
Computing method	Computed from the frequency based on the number of pulses per rotation RPMs = Frequency/(pulse/rotate value) × 60
Selectable pulse/rotate range	1 to 99999
RPSs	
Measurable RPSs range	0.001 rps to 2000 rps (where the input frequency is DC to 200 kHz).
Selectable vertical axis sensitivity	0.01 rps/div to 200 rps/div (1-2-5 steps)
Computing method	Computed from the frequency based on the number of pulses per rotation RPSs = Frequency/(pulse/rotate value)
Selectable pulse/rotate range	1 to 99999
Period	
Measurable period range	5 μs to 50 s (where the minimum pulse width is 2 μs)
Selectable vertical axis sensitivity	10 μs/div to 5 s/div (1-2-5 steps)
Minimum resolution	0.1 μs
Duty cycle	
Measurable duty cycle range	0 to 100%
Selectable vertical axis sensitivity	1 %/div to 20 %/div (1-2-5 steps)
Measurable frequency range	0.1 Hz to 200 kHz
Measurement pulse selection	Select positive or negative pulse
Minimum resolution	0.01%
Power supply frequency	
Measurable frequency range	30 Hz to 70 Hz (when the center frequency is 50 Hz), 40 Hz to 80 Hz (when the center frequency is 60 Hz), 380 Hz to 420 Hz (when the center frequency is 400 Hz)
Selectable vertical axis sensitivity	0.1 Hz/div to 2 Hz/div (0.01 Hz resolution)
Center frequency setting	Select 50 Hz, 60 Hz, or 400 Hz
Minimum resolution	0.01 Hz
Pulse width	
Measurable pulse width	2 μs to 50 s (where the input frequency is up to 200 kHz)
Selectable vertical axis sensitivity	10 μs/div to 5 s/div (1-2-5 steps)
Measurement pulse selection	Select positive or negative pulse
Minimum resolution	0.1 μs
Pulse integration	
Maximum pulse count	2×10^9 pulses
Selectable vertical axis sensitivity	500.0E+18 value/div to 10.00E−21 value/div (1-2-5 range: total of 123 ranges)
Frequency measuring range	0.1 Hz to 200 kHz (where the minimum pulse width is 2 μs)
Computation function	Set the physical amount per pulse and display by converting the values intophysical values such as distance and flow rate.
Selectable Unit/Pulse range	−9.9999E+30 to +9.9999E+30
Counter reset	Manual reset and over-limit reset
Velocity	
Selectable vertical axis sensitivity	500.0 E+18 value/div to 10.00 E-21 value/div (1-2-5 range: total of 123 ranges)
Computing method	Set the amount of displacement per pulse and compute the velocity from the frequency Automatic unit time conversion of s, min, and hour.
Selectable Distance/Pulse range	−9.9999E+30 to +9.9999E+30

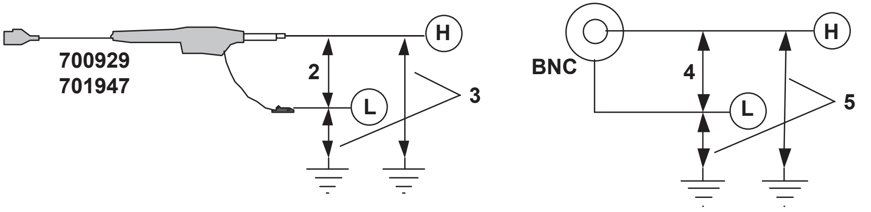
Functional Specifications

Item	Specifications
Deceleration prediction	Computes the deceleration condition in realtime when the pulse input is cut off. Can be specified when measuring the frequency, RPMs, RPSs, period, and velocity
Stop prediction	Sets the frequency to 0 after a certain time elapses after the pulse input is cut off. Stop interval setting: Set in the range of 1.5 to 10 times (10 settings) the period of the pulse measured last Can be specified when measuring the frequency, RPMs, RPSs, period, and velocity
Smoothing	Computes the moving average of the measured data using the specified time Specified time: 0.1 to 1000 ms (0.1 ms resolution) Can be specified on all measurement parameters
Pulse average	Performs frequency measurement per specified number of pulses. When fluctuation exists periodically in the pulse interval, the fluctuation can be eliminated. Specified number of pulses: 1 to 4096 Can be specified when measuring the frequency, RPMs, RPSs, power supply frequency, period, pulse integration, and velocity
Offset function	Observe fluctuation with respect to the offset frequency Offset range: Can be set up to 1000 times the maximum div value • Frequency: 0 Hz to 200 kHz • RPMs: 0 rpm to 50 krpm • RPSs: 0 rps to 1000 rps • Period: 0 s to 50 s • Duty cycle: 0% to 100% • Pulse width: 0 s to 50 s • Pulse integration: -1.0000×10^{22} to 1.0000×10^{22} • Velocity: -1.0000×10^{22} to 1.0000×10^{22}

High-Speed 100 MS/s, 12-Bit Isolation Module (720210) Specifications

Item	Specifications
Standard operating conditions	Temperature: 23 ±5°C Humidity: 20 to 80% RH After a 30-minute warm-up and after calibration
Effective measurement range	20 div (display range: 10 div)
Number of input channels	2
Input coupling	AC, DC, and GND
Maximum sample rate	100 MS/s
Input format	Isolated unbalanced
Frequency characteristics[1]	(−3 dB point when sine wave of amplitude ±3 div is applied) DC to 20 MHz
Voltage-axis sensitivity setting	10 mV/div to 20 V/div (1-2-5 steps) (when using 1:1 probe attenuation)
Maximum input voltage (at a frequency of 1 kHz or less)	Combined with the 700929 (10:1) or 701947 (100:1):[2] 1000 V (DC+ACpeak) CAT II Direct input (cable that does not comply with the safety standards):[4] 200 V (DC+ACpeak)
Maximum allowable common mode voltage (at a frequency of 1 kHz or less)	Working voltage of safety standard Combined with the 700929 (10:1) or 701947 (100:1):[3] 1000 Vrms (CAT II) Direct input (cable that does not comply with the safety standards):[5] 42 V (DC+ACpeak) (CAT II, 30 Vrms)
Vertical (voltage) axis accuracy DC accuracy[1]	10 mV/div to 20 V/div: ±(0.5% of 10 div)
Input connector	BNC connector (isolated type)
Input impedance	1 MΩ ± 1%, approx. 35 pF
−3 dB point when AC coupled low frequency attenuation point	10 Hz or less (1 Hz or less when using the 700929, 0.1 Hz or less when using the 700929)
Common mode rejection ratio	80 dB (50/60 Hz) or more (Typical[6])
Residual noise level (Input section shorted)	±1.1 mV or ±0.15 /div whichever is greater (Typical[6])
Withstand voltage	1500 Vrms for 1 minute (across each terminal and earth) (60 Hz)
Insulation resistance	500 VDC, 10 MΩ or more (across each input terminal and earth)
A/D conversion resolution	12 bit (150 LSB/div)
Temperature coefficient	Zero point: 10 mV/div to 20 V/div: ±(0.1% of 10 div)/°C(Typical[6]) Gain: ±(0.05% of 10 div)/°C(Typical[6])
Bandwidth limit	Select from OFF, 2 MHz, 1.28 MHz, 640 kHz, 320 kHz, 160 kHz, 80 kHz, , 40 kHZ, 20 kHz, and 10 kHz Cut-off characteristics: −12 dB/OCT (when 2 MHz, Typical[6])
Probe attenuation setting	Voltage probe: 1:1, 10:1, 100:1, 1000:1 Current probe: 10 A:1 V (for the 700937/701933), 100 A: 1 V (for the 701930/701931)

1 Value measured under standard operating conditions.


Combined with the 700929 or 701947

Direct input (cable that does not comply with the safety standards)

Withstand voltage: 1500 Vrms for 1 minute
Allowable transient surge voltage (between earth and input): ±2100 Vpeak

6 Typical value represents a typical or average value. It is not strictly warranted.

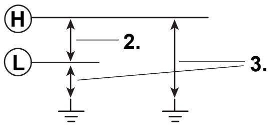
WARNING

- Do not apply input voltage exceeding the maximum input voltage or allowable common mode input voltage.
- To prevent the possibility of electric shock, be sure to furnish protective earth grounding of the DL850E/DL850EV.
- To prevent the possibility of electric shock, be sure to fasten the module screws. Otherwise, the electrical and mechanical protection functions will not be activated.
- Avoid continuous connection under an environment in which the surge voltage may occur.

16-CH Voltage Input Module (720220) Specifications

Item	Specifications
Standard operating conditions	Ambient temperature: 23 ± 5°C Ambient humidity: 20 to 80% RH After the DL850E/DL850EV has been warmed up for 30 minutes and then calibration has been performed
Valid measurement range	20 div (0 V ± 10 div. Display range: 10 div. When Variable is set to OFF)
Number of input channels	16
Input coupling settings	DC, GND, and OFF
Maximum sample rate	200 kS/s for a single channel, 16 ch × 10 kS/s
Input format	All isolated unbalanced
Frequency characteristics[1] (−3 dB point when a sine wave with an amplitude of ±3 div is applied)	DC to 5 kHz
Selectable voltage sensitivity range	0.2 V/div to 2 V/div (in 1-2-5 steps)
Max. measurement voltage range	±20 V
Maximum input voltage[2] (at a frequency of 1 kHz or less)	Direct input 42 V (DC + ACpeak)
Maximum allowable common mode voltage[3] (at a frequency of 1 kHz or less)	The Working Voltage in the safety standards Direct input 42 V (DC + ACpeak) (CAT II, 30 Vrms)
DC vertical-axis (voltage-axis) accuracy[1]	± (0.3% of 10 div)
Input connector	Spring terminal blocks. Each 8-channel unit is removable.
Input impedance	1 MΩ ± 1%
Common mode rejection ratio	80 dB (50/60 Hz) or more (typical value[4])
Residual noise level (input section shorted)	±0.05 div
A/D converter resolution	16 bits, 2400 LSB/div
Temperature coefficient	Zero point: ±(0.02% of 10 div)/°C (typical value[4]) Gain: ±(0.02% of 10 div)/°C (typical value[4])
Bandwidth limit	Can be turned off or set to 500 Hz on each sub channel
Wiring	Recommended: 0.20 mm^2 to 1.00 mm^2. AWG size: 24-18.

1 Value measured under standard operating conditions.



4 Typical value represents a typical or average value. It is not strictly warranted.

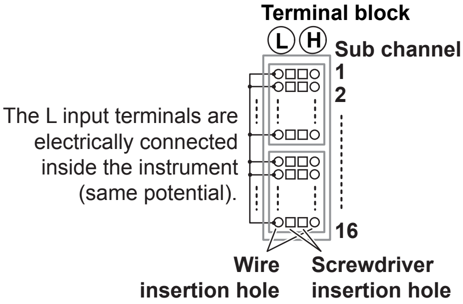
WARNING

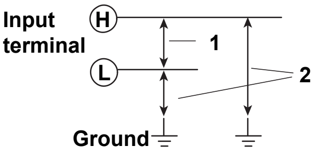
- When connecting a device under measurement to the instrument, be sure to turn off the device. It is extremely dangerous to connect or remove wires while the device under measurement is on.

Avoid Electric Shock When Using the Modules

- Do not apply a voltage that exceeds the maximum input voltage, withstand voltage, or allowable surge voltage.
- To avoid electric shock, be sure to ground the instrument.
- To prevent the possibility of electric shock, be sure to fasten the module screws. Otherwise, the electrical and mechanical protection functions will not be activated.
- Do not leave the instrument connected to devices in an environment that may be subject to voltage surges.
- To prevent electric shock, connect wires to the terminal block that match the voltage range that you are measuring.

- Applying a voltage greater than the limits listed below may damage the input section. For frequencies above 1 kHz, damage may occur even if the voltage is less than the limits listed below.
  Maximum input voltage between H and L input terminals when the frequency is 1 kHz or less[1]
  42 V (DC + ACpeak)
  Maximum allowable common mode voltage between the H or L input terminal and the ground when the frequency is 1 kHz or less[2]
  42V (DC + ACpeak) (CAT II, 30 Vrms)
- Wire all the L input terminals for all the sub channels on the same module to the same potential. The L input terminals of the sub channels are all connected. Because the L input terminals are electrically connected inside the DL850E/DL850EV, connecting different potentials to them could result in short circuiting and damage to the 16-CH voltage input module.


Terminal block
L
H
Sub channel
1
2
16
The L input terminals are electrically connected inside the instrument (same potential).
Wire insertion hole
Screwdriver insertion hole


Input terminal
H
L
1
2
Ground

- When you release or lock the terminal block release levers, be careful not to injure yourself on the levers' protrusions.

CAUTION

When you attach the terminal block, if you try to attach it upside down, you may damage the terminal block and the module. Check the vertical orientation of the block before you install it.

16-CH Temperature/Voltage Input Module (720221) Specifications

Item	Specifications
Standard operating conditions	Temperature: 23 ±5°C Humidity: 20 to 80% RH After a 30-minute warm-up and after calibration
Function	Temperature (thermocouple) or voltage measurement (DC coupling)
Effective measurement range	Voltage measurement: 20 div (display range: 10 div)
Number of input channels	16
Input coupling	TC, DC, OFF, and GND TC: Temperature (thermocouple) measurement DC: Voltage measurement (DC coupling) Can be set separately for each sub channel
Data update period	100 ms, 300 ms, 1 s, 3 s
Input format	Isolated unbalanced
Measurement range/accuracy[1] For the thermocouple standards, see the 701261 specifications.	[Voltage measurement] Voltage sensitivity: 1 mV/div to 2 V/div (1-2-5 steps) Voltage accuracy: ±(0.15% of 10 div) [Temperature measurement][2]

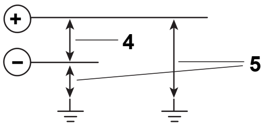
Type	Measurement Range	Accuracy
K	−200 to 1300°C	±(0.1% of reading + 1.5°C)
E	−200 to 800°C	Except ±(0.2% of reading + 1.5°C)
J	−200 to 1100°C	for −200°C to 0°C
T	−200 to 400°C	
L	−200 to 900°C	
U	−200 to 400°C	
N	0 to 1300°C	
R	0 to 1700°C	±(0.1% of reading + 3°C)
S	0 to 1700°C	Except, 0 to 200°C: ±8°C 200 to 800°C: ±5°C
B	0 to 1800°C	±(0.1% of reading + 2°C) Except, 400 to 700°C: ±8°C Effective range is 400 to 1800°C
W	0 to 2300°C	±(0.1% of reading + 3°C)
Au7Fe[3]	0 to 300K	0 to 50K: ±4K 50 to 300K: ±2.5K

Item	Specifications
Maximum input voltage[4] (at a frequency of 1 kHz or less)	Both temperature and voltage input: 42 V (DC + ACpeak)
Maximum allowable common mode voltage[5] (at a frequency of 1 kHz or less)	Both temperature and voltage input: 42 V (DC+ACpeak) (CAT II, 30 Vrms)
Vertical resolution	[Voltage measurement] During voltage input: 2400 LSB/div [Temperature measurement] When measuring temperature: 0.1°C
Common mode rejection ratio	[Voltage measurement] 100 dB (50/60 Hz) or more (Typical[6]) [Temperature measurement] 140 dB or more (50/60 Hz, with data update period = 3 seconds) (Typical[6])
Residual noise level (Input section shorted)	±0.01 div (Typical[6])
A/D conversion resolution	[Voltage measurement] 16 bits (2400 LSB/range)
Temperature coefficient	[Voltage measurement] Zero point: ±(0.025% of 10 div)/°C (Typical[6]) Gain: ±(0.01% of 10 div)/°C (Typical[6])
Reference junction compensation accuracy (when the input terminal temperature is balanced)	K, E, J, T, L, U, N: ±1°C R, S, B, W: ±1.5°C Au7Fe: ±1K
Bandwidth limit (Typical[6]) (−3 dB point)	Data update period: 100 ms: 600 Hz 300 ms: 200 Hz 1 s: 50 Hz 3 s: 10 Hz
Input connector	Screw type
Input impedance	Approx. 1 MΩ
Interference between sub channels:	100 dB (50/60 Hz) or more (Typical[6])
External scanner box	Model number: 701953, built-in reference junction Length of included cable: 1 m, 3 m (selectable)

1 Value measured under standard operating conditions.

2 Does not include the reference junction temperature compensation accuracy.

3 This module supports Au7Fe with 0.07% metal content with respect to gold.



6 Typical value represents a typical or average value. It is not strictly warranted.

WARNING

- When connecting a device under measurement to the instrument, be sure to turn off the device. It is extremely dangerous to connect or disconnect wires while the device under measurement is on.

Precautions to Be Taken When Using the Modules

- To avoid electric shock, be sure to ground the instrument.
- To prevent the possibility of electric shock, be sure to fasten the module screws. Otherwise, the electrical protection function and the mechanical protection function will not be activated.

Precautions to Be Taken When Using the 16-CH Scanner Box

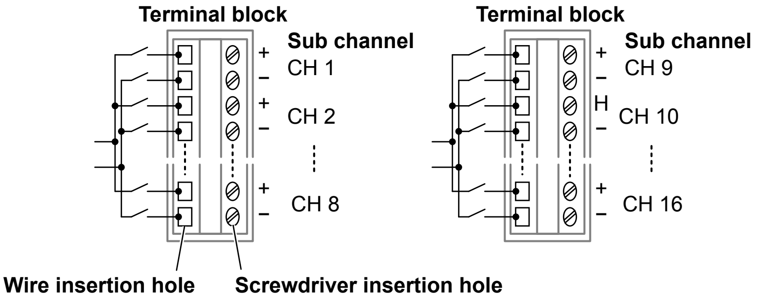
- Do not connect or disconnect the 16-CH scanner box or the cables that are connected to it while the power is on.
- Do not apply input voltage exceeding the maximum input voltage, withstand voltage, or allowable surge voltage.
- Do not leave the instrument connected to devices in an environment that may be subject to voltage surges.
- To prevent electric shock, connect wires to the terminal block that match the voltage range that you are measuring.
- Applying a voltage exceeding the value indicated below may damage the input section. If the frequency is above 1 kHz, damage may occur even when the voltage is below this value.

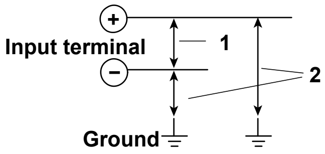
  Maximum input voltage (across the input terminals, + and −,[1] at a frequency of 1 kHz or less)

  42 V (DC + ACpeak)

  Maximum allowable common mode voltage (across the input terminals, + or −, and earth,[2] at a frequency of 1 kHz or less)

  42 V (DC + ACpeak) (CAT II, 30 Vrms)
- The − input terminals of the sub channels are electrically insulated inside the scanner box. If you connect a wire that has a potential difference greater than 42 V (DC + ACpeak) between sub channels, the insulation may be damaged, which will lead to the 16-CH scanner box being damaged.





CAUTION

- Correct measurements cannot be obtained when the positive and negative thermocouple leads are connected in reverse.
- Immediately after connecting the thermocouple, the heat balance may be disturbed at the input terminal section and may cause measurement errors. Therefore, wait about ten minutes before making a measurement.
- In an environment where the air from the air conditioning is directly applied to the input terminals or where there are effects from a heat source, the heat balance may be disturbed at the input terminal section and cause measurement errors.
  When making measurements in this type of environment, take preventive measures such as changing the position.

Logic Input Module (720230) Specifications

Item	Specifications
Standard operating conditions	Ambient temperature: 23 ± 5°C Ambient humidity: 20 to 80% RH
Number of input ports	2
Number of input bits	8 bits per port
Maximum sample rate	10 MS/s
Input format	Use a non-isolated, dedicated probe (automatic detection)
Compatible probes	700986 (non-isolated 8-bit input) 700987 (isolated 8-bit input) 702911 (non-isolated 8-bit input) 702912 (non-isolated 8-bit input)
Chatter suppression time settings	Off, 5 ms, 10 ms, 20 ms, 50 ms, and 100 ms

CAUTION

- Applying a voltage greater than the limits listed below may damage the logic probe or the instrument. For frequencies above 1 kHz, damage may occur even if the voltage is less than the limits listed below.
  Maximum input voltage (at a frequency of 1 kHz or less)
  - Logic probes 702911 and 702912: 35 V
  - High-speed logic probe 700986: 42 V (DC + ACpeak)
  - Isolated logic probe 700987: 250 Vrms (however, ACpeak must be less than 350 V, and DC must be less than 250 V)
- For logic probes 702911, 702912, 700986, and the high-speed logic probe, the eight input lines of a single pod share the same ground. Also, the instrument's ground and the grounds of each pod are connected. Do not apply signals with different common voltages to each input line. Doing so may damage the instrument, connected logic probes, and connected devices.
- The input terminals of an isolated logic probe are isolated from each other and from the DL850E/DL850EV.
- Turn off the DL850E/DL850EV before you connect or remove a 26-pin connector from the logic signal input connector.
- Do not stack isolated logic probes. Also, to prevent a probe's internal temperature from rising, provide a sufficient amount of space around it.
- Do not use the YOKOGAWA 700985 logic probe with the DL850E/DL850EV. The 700985 is shaped so that it can be connected to the logic signal input connector of the DL850E/DL850EV, but it is not electrically compatible with the DL850E/DL850EV, so connecting the two could damage the DL850E/DL850EV or the 700985.

CAN Bus Monitor Module (720240) Specification

Item	Specifications
Standard operating condition	Ambient temperature: 23±5°C Ambient humidity: 20 to 80% RH
Number of input ports	2
Maximum sample rate	100 kS/s
Input format	Isolated unbalanced
Maximum input voltage	–3 to +10 V (between CAN_H and GND or CAN_L and GND)
Maximum allowable common mode voltage	42 V (DC+ACpeak) (CAT II, 30 Vrms)
Input connector	D-sub 9 pin (male)
Terminator	Internal, can be enabled or disabled for each port
Supported protocol	Physical layer: ISO-11898 (High Speed Communication)
Supported bit rates[1]	10 kbps, 20 kbps, 33.3 kbps, 50 kbps, 62.5 kbps, 66.7 kbps, 83.3 kbps, 100 kbps, 125 kbps, 250 kbps, 500 kbps, 800 kbps, 1 Mbps
LED display	Illuminates to indicate that the terminator is enabled
Number of sub channels	16 sub channels/ports (60 for firmware versions 1.20 and later)
One shot output	Frames can be output in single shots
Terminator resistance (when the terminator is enabled)	110 to 130 Ω
A/D converter resolution (when Value Type is set to Float[2])	16 bits, 2400 LSB/div

1 Low-speed CAN at low-speed transceiver levels is not supported. The 100 kbps covers firmware versions 1.30 and later of the DL850E/DL850EV.

2 Applies to modules whose firmware version is 1.20 and later

CAN & LIN Bus Monitor Module (720241) Specification

Item	Specifications
Standard operating condition	Ambient temperature: 23±5°C Ambient humidity: 20 to 80% RH
Number of input ports	CAN port: 1. LIN port: 1.
Maximum sample rate	100 kS/s
Input format	Isolated unbalanced

CAN port specifications

Item	Specifications
Maximum input voltage	–3 to +10 V (between CAN_H and GND or CAN_L and GND)
Maximum allowable common mode voltage	42 V (DC+ACpeak) (CAT II, 30 Vrms)
Input connector	D-sub 9 pin (male)
Terminator	Internal, can be enabled or disabled
Terminator resistance (when the terminator is enabled)	110 to 130 Ω
LED display	Illuminates to indicate that the terminator is enabled
Supported protocol	Physical layer: ISO-11898 (High Speed Communication)
Supported bit rates[1]	10 kbps, 20 kbps, 33.3 kbps, 50 kbps, 62.5 kbps, 66.7 kbps, 83.3 kbps, 100 kbps, 125 kbps, 250 kbps, 500 kbps, 800 kbps, 1 Mbps
Supported data length	4 bytes maximum
Number of sub channels	60 sub channels
One shot output	Frames can be output in single shots
A/D converter resolution (when Value Type is set to Float)	16 bits, 2400 LSB/div

[1] Low-speed CAN at low-speed transceiver levels is not supported.

LIN port specifications

Item	Specifications
Maximum input voltage	–0.3 to +18 V (between LIN.VBAT and GND)
Maximum allowable common mode voltage	30 Vrms (CAT I and II)
Input connector	D-sub 9 pin (male)
Supported protocol	Physical layer: : Complies with ISO9141
Supported bit rates	2400bps, 9600bps, 19200bps
Supported data length	4 bytes maximum
Number of sub channels	60 sub channels
Supported check sums	Standard check sum, extended check sum

6.14 Logic Probe Specifications

High-Speed Logic Probe (700986) Specifications

Item	Specifications
Number of inputs	8
Input format	Non-isolated (all the bits share the same ground with the DL850E/DL850EV and each other)
Maximum input voltage	42V (DC + ACpeak) (CAT II, 30 Vrms), between the probe tip and ground (at a frequency of 1 kHz or less)
Response time	Within 1 μs
Input impedance	100 kΩ or more
Threshold level	Approx. 1.4 V

Isolated Logic Probe (700987) Specifications

Item	Specifications
Number of inputs	8
Input format	Isolated (all bits are isolated)
Input connector	Safety terminal type (for banana plug) × 8
Input switching	Each bit can be switched to AC or DC input.
Input signal display	The H/L state of each bit is indicated with LEDs (the LEDs illuminate to indicate H).
Applicable input range	During DC input: H/L detection of 10 VDC to 250 VDC During AC input: H/L detection of 80 VAC to 250 VAC at 50/60 Hz
Threshold level	During DC input: 6 V ± 50% (High level: 10 to 250 VDC, Low level: 0 to 3 VDC) During AC input: 50 VAC ± 50% (High level: 80 to 250 VAC, Low level: 0 to 20 VAC)
Response time	During DC input: 1 ms or less During AC input: 20 ms or less
Input impedance	Approx. 100 kΩ
Maximum input voltage (between the H and L terminals of each bit)	250 Vrms[1] (CAT II)
Maximum allowable common mode voltage (between input terminal H or L and the ground)	250 Vrms[1] (CAT II)
Maximum allowable voltage between bits	250 Vrms[1] (CAT II)
Withstand voltage (between the input terminals and the ground)	2000 VAC for 1 minute
Insulation resistance (between the input terminals and the ground)	500 VDC, 10 MΩ or greater

Fuse[2]	Location	Max. rated voltage	Max. rated current	Type	Standard
	H side of input terminal	250 V	50 mA	Time lag	VDE/SEMKO approved

[1] Make sure that the peak AC voltage does not exceed 350 V and that the DC voltage does not exceed 250 V when the frequency is 1 kHz or less.

[2] Because the fuses used by this instrument are all inside the case, you cannot replace them yourself. If you believe that the fuse inside the case has blown, please contact your nearest YOKOGAWA dealer.

Logic Probe (702911 and 702912) Specifications

Item	Specifications
Number of inputs	8
Input format	Non-isolated (all the bits share the same ground with the DL850E/DL850EV and each other)
Maximum input voltage	±35 V
Response time	Within 3 μs
Input impedance	10 kΩ or more
Threshold level	Approx. 1.4 V
Input methods	TTL level or contact input (switchable). During contact input: Pulled up to 5 V

6.15 16-CH Scanner Box Specifications

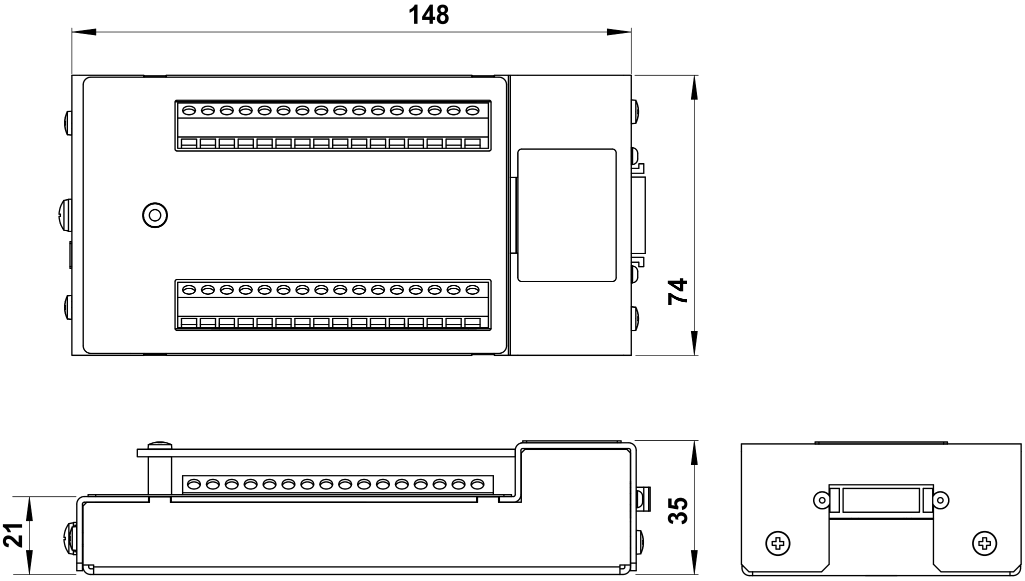
For the specifications other than the dimensions of the 16-CH Scanner Box, see the 16-CH temperature/voltage input module (720221) specifications.

External Dimensions

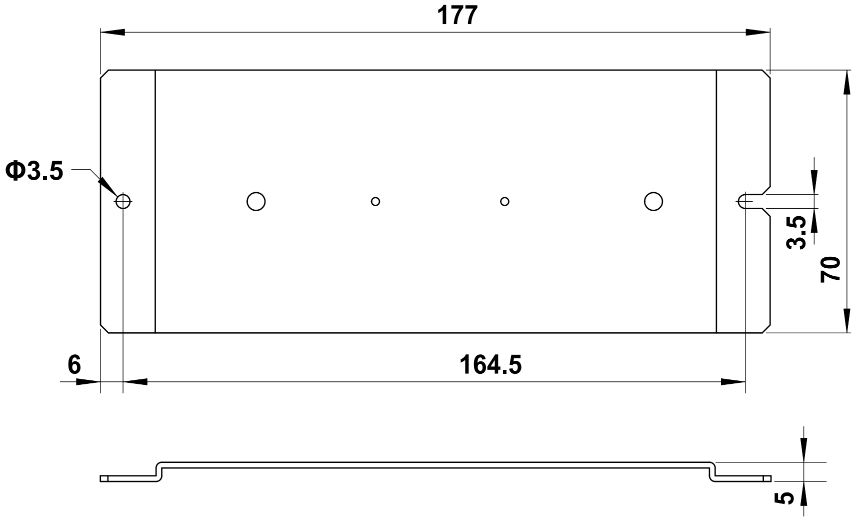
Unit: mm

Unless otherwise specified, tolerances are ±3% (however, tolerances are ±0.3 mm when below 10 mm).

16-CH Scanner Box



Attaching plate

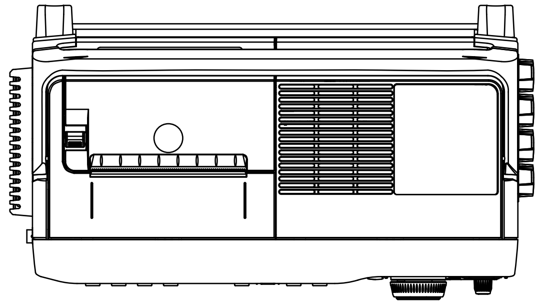


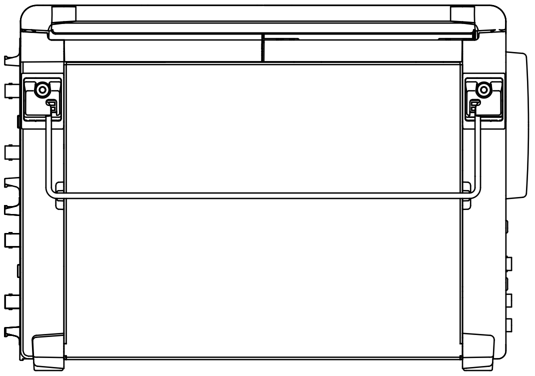
6.16 External Dimensions

DL850E/DL850EV

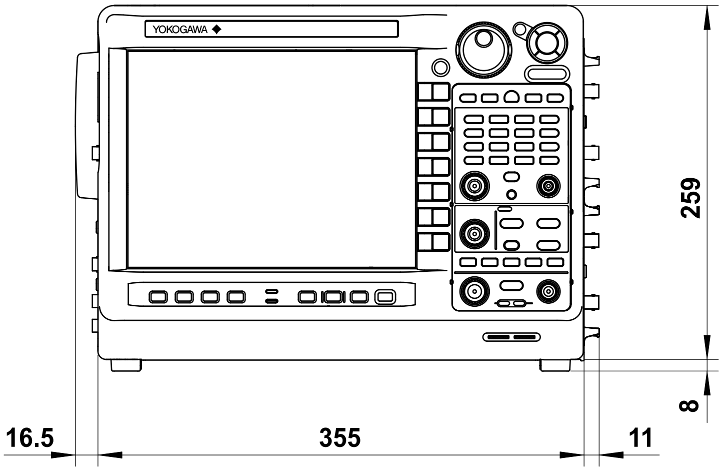
Unit: mm

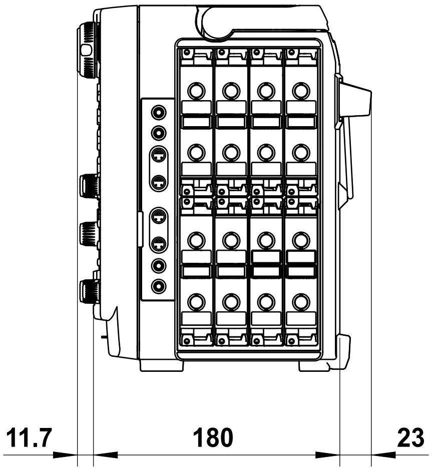
Unless otherwise specified, tolerances are ±3% (however, tolerances are ±0.3 mm when below 10 mm).



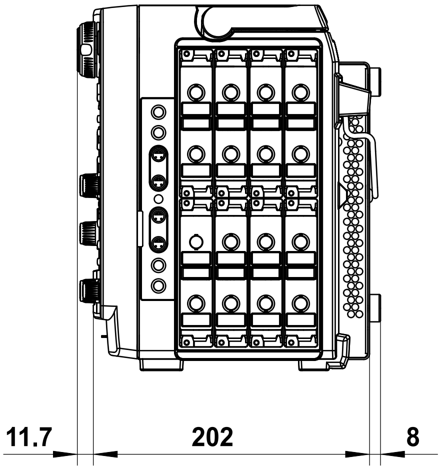


Rear view


YOKOGAWA
259
8
16.5
355
11



DC Power Model



Appendix 1 Relationship between the Time Axis Setting, Record Length, and Sample Rate

When the High-Speed 100 MS/s, 12-Bit Isolation Module Is Installed

When the Record Length Is 1 kpoint, 2.5 kpoint, 5 kpoint, 10 kpoint, or 25 kpoint

Time/div	Record									
	1 kpoint		2.5 kpoint		5 kpoint		10 kpoint		25 kpoint	
	Sample Rate (S/s)	Display Record Length (Points)	Sample Rate (S/s)	Display Record Length (Points)	Sample Rate (S/s)	Display Record Length (Points)	Sample Rate (S/s)	Display Record Length (Points)	Sample Rate (S/s)	Display Record Length (Points)
100 ns	100 M	100	100 M	100	100 M	100	100 M	100	100 M	100
200 ns	100 M	200	100 M	200	100 M	200	100 M	200	100 M	200
500 ns	100 M	500	100 M	500	100 M	500	100 M	500	100 M	500
1 µs	100 M	1 k	100 M	1 k	100 M	1 k	100 M	1 k	100 M	1 k
2 µs	50 M	1 k	100 M	2 k	100 M	2 k	100 M	2 k	100 M	2 k
5 µs	20 M	1 k	50 M	2.5 k	100 M	5 k	100 M	5 k	100 M	5 k
10 µs	10 M	1 k	20 M	2 k	50 M	5 k	100 M	10 k	100 M	10 k
20 µs	5 M	1 k	10 M	2 k	20 M	4 k	50 M	10 k	100 M	20 k
50 µs	2 M	1 k	5 M	2.5 k	10 M	5 k	20 M	10 k	50 M	25 k
100 µs	1 M	1 k	2 M	2 k	5 M	5 k	10 M	10 k	20 M	20 k
200 µs	500 k	1 k	1 M	2 k	2 M	4 k	5 M	10 k	10 M	20 k
500 µs	200 k	1 k	500 k	2.5 k	1 M	5 k	2 M	10 k	5 M	25 k
1 ms	100 k	1 k	200 k	2 k	500 k	5 k	1 M	10 k	2 M	20 k
2 ms	50 k	1 k	100 k	2 k	200 k	4 k	500 k	10 k	1 M	20 k
5 ms	20 k	1 k	50 k	2.5 k	100 k	5 k	200 k	10 k	500 k	25 k
10 ms	10 k	1 k	20 k	2 k	50 k	5 k	100 k	10 k	200 k	20 k
20 ms	5 k	1 k	10 k	2 k	20 k	4 k	50 k	10 k	100 k	20 k
50 ms	2 k	1 k	5 k	2.5 k	10 k	5 k	20 k	10 k	50 k	25 k
100 ms	1 k	1 k	2 k	2 k	5 k	5 k	10 k	10 k	20 k	20 k
200 ms	500	1 k	1 k	2 k	2 k	4 k	5 k	10 k	10 k	20 k
500 ms	200	1 k	500	2.5 k	1 k	5 k	2 k	10 k	5 k	25 k
1 s	100	1 k	200	2 k	500	5 k	1 k	10 k	2 k	20 k
2 s	50	1 k	100	2 k	200	4 k	500	10 k	1 k	20 k
3 s	20	600	50	1.5 k	100	3 k	200	6 k	500	15 k
4 s	20	800	50	2 k	100	4 k	200	8 k	500	20 k
5 s	20	1 k	50	2.5 k	100	5 k	200	10 k	500	25 k
6 s	10	600	20	1.2 k	50	3 k	100	6 k	200	12 k
8 s	10	800	20	1.6 k	50	4 k	100	8 k	200	16 k
10 s	10	1 k	20	2 k	50	5 k	100	10 k	200	20 k
20 s	5	1 k	10	2 k	20	4 k	50	10 k	100	20 k
30 s			5	1.5 k	10	3 k	20	6 k	50	15 k
1 min					5	3 k	10	6 k	20	12 k
2 min							5	6 k	20	24 k
3 min							5	9 k	10	18 k
4 min									10	24 k
5 min									5	15 k
6 min									5	18 k
7 min									5	21 k

When the time axis setting is 100 ms or greater (the settings surrounded by bold lines) and the trigger mode is Auto or Auto Level, waveforms are displayed in roll mode.

When the Record Length Is 50 kpoint, 100 kpoint, 250 kpoint, 500 kpoint, or 1 Mpoint

Time/div	Record Length									
	50 kpoint		100 kpoint		250 kpoint		500 kpoint		1 Mpoint	
	Sample Rate (S/s)	Display Record Length (Points)	Sample Rate (S/s)	Display Record Length (Points)	Sample Rate (S/s)	Display Record Length (Points)	Sample Rate (S/s)	Display Record Length (Points)	Sample Rate (S/s)	Display Record Length (Points)
100 ns	100 M	100	100 M	100	100 M	100	100 M	100	100 M	100
200 ns	100 M	200	100 M	200	100 M	200	100 M	200	100 M	200
500 ns	100 M	500	100 M	500	100 M	500	100 M	500	100 M	500
1 μs	100 M	1 k	100 M	1 k	100 M	1 k	100 M	1 k	100 M	1 k
2 μs	100 M	2 k	100 M	2 k	100 M	2 k	100 M	2 k	100 M	2 k
5 μs	100 M	5 k	100 M	5 k	100 M	5 k	100 M	5 k	100 M	5 k
10 μs	100 M	10 k	100 M	10 k	100 M	10 k	100 M	10 k	100 M	10 k
20 μs	100 M	20 k	100 M	20 k	100 M	20 k	100 M	20 k	100 M	20 k
50 μs	100 M	50 k	100 M	50 k	100 M	50 k	100 M	50 k	100 M	50 k
100 μs	50 M	50 k	100 M	100 k	100 M	100 k	100 M	100 k	100 M	100 k
200 μs	20 M	40 k	50 M	100 k	100 M	200 k	100 M	200 k	100 M	200 k
500 μs	10 M	50 k	20 M	100 k	50 M	250 k	100 M	500 k	100 M	500 k
1 ms	5 M	50 k	10 M	100 k	20 M	200 k	50 M	500 k	100 M	1 M
2 ms	2 M	40 k	5 M	100 k	10 M	200 k	20 M	400 k	50 M	1 M
5 ms	1 M	50 k	2 M	100 k	5 M	250 k	10 M	500 k	20 M	1 M
10 ms	500 k	50 k	1 M	100 k	2 M	200 k	5 M	500 k	10 M	1 M
20 ms	200 k	40 k	500 k	100 k	1 M	200 k	2 M	400 k	5 M	1 M
50 ms	100 k	50 k	200 k	100 k	500 k	250 k	1 M	500 k	2 M	1 M
100 ms	50 k	50 k	100 k	100 k	200 k	200 k	500 k	500 k	1 M	1 M
200 ms	20 k	40 k	50 k	100 k	100 k	200 k	200 k	400 k	500 k	1 M
500 ms	10 k	50 k	20 k	100 k	50 k	250 k	100 k	500 k	200 k	1 M
1 s	5 k	50 k	10 k	100 k	20 k	200 k	50 k	500 k	100 k	1 M
2 s	2 k	40 k	5 k	100 k	10 k	200 k	20 k	400 k	50 k	1 M
3 s	1 k	30 k	2 k	60 k	5 k	150 k	10 k	300 k	20 k	600 k
4 s	1 k	40 k	2 k	80 k	5 k	200 k	10 k	400 k	20 k	800 k
5 s	1 k	50 k	2 k	100 k	5 k	250 k	10 k	500 k	20 k	1 M
6 s	500	30 k	1 k	60 k	2 k	120 k	5 k	300 k	10 k	600 k
8 s	500	40 k	1 k	80 k	2 k	160 k	5 k	400 k	10 k	800 k
10 s	500	50 k	1 k	100 k	2 k	200 k	5 k	500 k	10 k	1 M
20 s	200	40 k	500	100 k	1 k	200 k	2 k	400 k	5 k	1 M
30 s	100	30 k	200	60 k	500	150 k	1 k	300 k	2 k	600 k
1 min	50	30 k	100	60 k	200	120 k	500	300 k	1 k	600 k
2 min	20	24 k	50	60 k	200	240 k	200	240 k	500	600 k
3 min	20	36 k	50	90 k	100	180 k	200	360 k	500	900 k
4 min	20	48 k	20	48 k	100	240 k	200	480 k	200	480 k
5 min	10	30 k	20	60 k	50	150 k	100	300 k	200	600 k
6 min	10	36 k	20	72 k	50	180 k	100	360 k	200	720 k
7 min	10	42 k	20	84 k	50	210 k	100	420 k	200	840 k
8 min	10	48 k	20	96 k	50	240 k	100	480 k	200	960 k
9 min	5	27 k	10	54 k	20	108 k	50	270 k	100	540 k
10 min	5	30 k	10	60 k	20	120 k	50	300 k	100	600 k
12 min	5	36 k	10	72 k	20	144 k	50	360 k	100	720 k
15 min	5	45 k	10	90 k	20	180 k	50	450 k	100	900 k
30 min			5	90 k	10	180 k	20	360 k	50	900 k
1 h					5	180 k	10	360 k	20	720 k
2 h							5	360 k	10	720 k
3 h									5	540 k
4 h									5	720 k
5 h									5	900 k

When the time axis setting is 100 ms or greater (the settings surrounded by bold lines) and the trigger mode is Auto or Auto Level, waveforms are displayed in roll mode.

When the Record Length Is 2.5 Mpoint, 5 Mpoint, 10 Mpoint, 25 Mpoint, or 50 Mpoint

	Record Length									
	2.5 Mpoint		5 Mpoint		10 Mpoint		25 Mpoint		50 Mpoint	
Time/div	Sample Rate (S/s)	Display Record Length (Points)	Sample Rate (S/s)	Display Record Length (Points)	Sample Rate (S/s)	Display Record Length (Points)	Sample Rate (S/s)	Display Record Length (Points)	Sample Rate (S/s)	Display Record Length (Points)
100 ns	100 M	100	100 M	100	100 M	100	100 M	100	100 M	100
200 ns	100 M	200	100 M	200	100 M	200	100 M	200	100 M	200
500 ns	100 M	500	100 M	500	100 M	500	100 M	500	100 M	500
1 µs	100 M	1 k	100 M	1 k	100 M	1 k	100 M	1 k	100 M	1 k
2 µs	100 M	2 k	100 M	2 k	100 M	2 k	100 M	2 k	100 M	2 k
5 µs	100 M	5 k	100 M	5 k	100 M	5 k	100 M	5 k	100 M	5 k
10 µs	100 M	10 k	100 M	10 k	100 M	10 k	100 M	10 k	100 M	10 k
20 µs	100 M	20 k	100 M	20 k	100 M	20 k	100 M	20 k	100 M	20 k
50 µs	100 M	50 k	100 M	50 k	100 M	50 k	100 M	50 k	100 M	50 k
100 µs	100 M	100 k	100 M	100 k	100 M	100 k	100 M	100 k	100 M	100 k
200 µs	100 M	200 k	100 M	200 k	100 M	200 k	100 M	200 k	100 M	200 k
500 µs	100 M	500 k	100 M	500 k	100 M	500 k	100 M	500 k	100 M	500 k
1 ms	100 M	1 M	100 M	1 M	100 M	1 M	100 M	1 M	100 M	1 M
2 ms	100 M	2 M	100 M	2 M	100 M	2 M	100 M	2 M	100 M	2 M
5 ms	50 M	2.5 M	100 M	5 M	100 M	5 M	100 M	5 M	100 M	5 M
10 ms	20 M	2 M	50 M	5 M	100 M	10 M	100 M	10 M	100 M	10 M
20 ms	10 M	2 M	20 M	4 M	50 M	10 M	100 M	20 M	100 M	20 M
50 ms	5 M	2.5 M	10 M	5 M	20 M	10 M	50 M	25 M	100 M	50 M
100 ms	2 M	2 M	5 M	5 M	10 M	10 M	20 M	20 M	50 M	50 M
200 ms	1 M	2 M	2 M	4 M	5 M	10 M	10 M	20 M	20 M	40 M
500 ms	500 k	2.5 M	1 M	5 M	2 M	10 M	5 M	25 M	10 M	50 M
1 s	200 k	2 M	500 k	5 M	1 M	10 M	2 M	20 M	5 M	50 M
2 s	100 k	2 M	200 k	4 M	500 k	10 M	1 M	20 M	2 M	40 M
3 s	50 k	1.5 M	100 k	3 M	200 k	6 M	500 k	15 M	1 M	30 M
4 s	50 k	2 M	100 k	4 M	200 k	8 M	500 k	20 M	1 M	40 M
5 s	50 k	2.5 M	100 k	5 M	200 k	10 M	500 k	25 M	1 M	50 M
6 s	20 k	1.2 M	50 k	3 M	100 k	6 M	200 k	12 M	500 k	30 M
8 s	20 k	1.6 M	50 k	4 M	100 k	8 M	200 k	16 M	500 k	40 M
10 s	20 k	2 M	50 k	5 M	100 k	10 M	200 k	20 M	500 k	50 M
20 s	10 k	2 M	20 k	4 M	50 k	10 M	100 k	20 M	200 k	40 M
30 s	5 k	1.5 M	10 k	3 M	20 k	6 M	50 k	15 M	100 k	30 M
1 min	2 k	1.2 M	5 k	3 M	10 k	6 M	20 k	12 M	50 k	30 M
2 min	2 k	2.4 M	2 k	2.4 M	5 k	6 M	20 k	24 M	20 k	24 M
3 min	1 k	1.8 M	2 k	3.6 M	5 k	9 M	10 k	18 M	20 k	36 M
4 min	1 k	2.4 M	2 k	4.8 M	2 k	4.8 M	10 k	24 M	20 k	48 M
5 min	500	1.5 M	1 k	3 M	2 k	6 M	5 k	15 M	10 k	30 M
6 min	500	1.8 M	1 k	3.6 M	2 k	7.2 M	5 k	18 M	10 k	36 M
7 min	500	2.1 M	1 k	4.2 M	2 k	8.4 M	5 k	21 M	10 k	42 M
8 min	500	2.4 M	1 k	4.8 M	2 k	9.6 M	5 k	24 M	10 k	48 M
9 min	200	1.08 M	500	2.7 M	1 k	5.4 M	2 k	10.8 M	5 k	27 M
10 min	200	1.2 M	500	3 M	1 k	6 M	2 k	12 M	5 k	30 M
12 min	200	1.44 M	500	3.6 M	1 k	7.2 M	2 k	14.4 M	5 k	36 M
15 min	200	1.8 M	500	4.5 M	1 k	9 M	2 k	18 M	5 k	45 M
30 min	100	1.8 M	200	3.6 M	500	9 M	1 k	18 M	2 k	36 M
1 h	50	1.8 M	100	3.6 M	200	7.2 M	500	18 M	1 k	36 M
2 h	20	1.44 M	50	3.6 M	100	7.2 M	200	14.4 M	500	36 M
3 h	20	2.16 M	20	2.16 M	50	5.4 M	200	21.6 M	200	21.6 M
4 h	10	1.44 M	20	2.88 M	50	7.2 M	100	14.4 M	200	28.8 M
5 h	10	1.8 M	20	3.6 M	50	9 M	100	18 M	200	36 M

When the time axis setting is 100 ms or greater (the settings surrounded by bold lines) and the trigger mode is Auto or Auto Level, waveforms are displayed in roll mode.

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Time/div	Record Length									
	2.5 Mpoint		5 Mpoint		10 Mpoint		25 Mpoint		50 Mpoint	
	Sample Rate (S/s)	Display Record Length (Points)	Sample Rate (S/s)	Display Record Length (Points)	Sample Rate (S/s)	Display Record Length (Points)	Sample Rate (S/s)	Display Record Length (Points)	Sample Rate (S/s)	Display Record Length (Points)
6 h	10	2.16 M	20	4.32 M	20	4.32 M	100	21.6 M	200	43.2 M
7 h	5	1.26 M	10	2.52 M	20	5.04 M	50	12.6 M	100	25.2 M
8 h	5	1.44 M	10	2.88 M	20	5.76 M	50	14.4 M	100	28.8 M
9 h	5	1.62 M	10	3.24 M	20	6.48 M	50	16.2 M	100	32.4 M
10 h	5	1.8 M	10	3.6 M	20	7.2 M	50	18 M	100	36 M
12 h	5	2.16 M	10	4.32 M	20	8.64 M	50	21.6 M	100	43.2 M
1 day			5	4.32 M	10	8.64 M	20	17.28 M	50	43.2 M
2 days					5	8.64 M	10	17.28 M	20	34.56 M
3 days							5	12.96 M	10	25.92 M
4 days							5	17.28M	10	34.56M
5 days							5	21.6M	10	43.2M
6 days									5	25.92M
8 days									5	34.56M
10 days									5	43.2M

When the time axis setting is 100 ms or greater (the settings surrounded by bold lines) and the trigger mode is Auto or Auto Level, waveforms are displayed in roll mode.

When the Record Length Is 100 Mpoint, 250 Mpoint, 500 Mpoint, 1 Gpoint, or 2 Gpoint

Time/div	Record Length									
	100 Mpoint		250 Mpoint		500 Mpoint		1 Gpoint		2 Gpoint	
	Sample Rate (S/s)	Display Record Length (Points)	Sample Rate (S/s)	Display Record Length (Points)	Sample Rate (S/s)	Display Record Length (Points)	Sample Rate (S/s)	Display Record Length (Points)	Sample Rate (S/s)	Display Record Length (Points)
100 ns	100 M	100	100 M	100	100 M	100	100 M	100	100 M	100
200 ns	100 M	200	100 M	200	100 M	200	100 M	200	100 M	200
500 ns	100 M	500	100 M	500	100 M	500	100 M	500	100 M	500
1 µs	100 M	1 k	100 M	1 k	100 M	1 k	100 M	1 k	100 M	1 k
2 µs	100 M	2 k	100 M	2 k	100 M	2 k	100 M	2 k	100 M	2 k
5 µs	100 M	5 k	100 M	5 k	100 M	5 k	100 M	5 k	100 M	5 k
10 µs	100 M	10 k	100 M	10 k	100 M	10 k	100 M	10 k	100 M	10 k
20 µs	100 M	20 k	100 M	20 k	100 M	20 k	100 M	20 k	100 M	20 k
50 µs	100 M	50 k	100 M	50 k	100 M	50 k	100 M	50 k	100 M	50 k
100 µs	100 M	100 k	100 M	100 k	100 M	100 k	100 M	100 k	100 M	100 k
200 µs	100 M	200 k	100 M	200 k	100 M	200 k	100 M	200 k	100 M	200 k
500 µs	100 M	500 k	100 M	500 k	100 M	500 k	100 M	500 k	100 M	500 k
1 ms	100 M	1 M	100 M	1 M	100 M	1 M	100 M	1 M	100 M	1 M
2 ms	100 M	2 M	100 M	2 M	100 M	2 M	100 M	2 M	100 M	2 M
5 ms	100 M	5 M	100 M	5 M	100 M	5 M	100 M	5 M	100 M	5 M
10 ms	100 M	10 M	100 M	10 M	100 M	10 M	100 M	10 M	100 M	10 M
20 ms	100 M	20 M	100 M	20 M	100 M	20 M	100 M	20 M	100 M	20 M
50 ms	100 M	50 M	100 M	50 M	100 M	50 M	100 M	50 M	100 M	50 M
100 ms	100 M	100 M	100 M	100 M	100 M	100 M	100 M	100 M	100 M	100 M
200 ms	50 M	100 M	100 M	200 M	100 M	200 M	100 M	200 M	100 M	200 M
500 ms	20 M	100 M	50 M	250 M	100 M	500 M	100 M	500 M	100 M	500 M
1 s	10 M	100 M	20 M	200 M	50 M	500 M	100 M	1 G	100 M	1 G
2 s	5 M	100 M	10 M	200 M	20 M	400 M	50 M	1 G	100 M	2 G
3 s	2 M	60 M	5 M	150 M	10 M	300 M	20 M	600 M	50 M	1.5 G
4 s	2 M	80 M	5 M	200 M	10 M	400 M	20 M	800 M	50 M	2 G
5 s	2 M	100 M	5 M	250 M	10 M	500 M	20 M	1 G	20 M	1 G

When the time axis setting is 100 ms or greater (the settings surrounded by bold lines) and the trigger mode is Auto or Auto Level, waveforms are displayed in roll mode.

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Time/div	Record Length									
	100 Mpoint		250 Mpoint		500 Mpoint		1 Gpoint		2 Gpoint	
	Sample Rate (S/s)	Display Record Length (Points)	Sample Rate (S/s)	Display Record Length (Points)	Sample Rate (S/s)	Display Record Length (Points)	Sample Rate (S/s)	Display Record Length (Points)	Sample Rate (S/s)	Display Record Length (Points)
6 s	1 M	60 M	2 M	120 M	5 M	300 M	10 M	600 M	20 M	1.2 G
8 s	1 M	80 M	2 M	160 M	5 M	400 M	10 M	800 M	20 M	1.6 G
10 s	1 M	100 M	2 M	200 M	5 M	500 M	10 M	1 G	20 M	2 G
20 s	500 k	100 M	1 M	200 M	2 M	400 M	5 M	1 G	10 M	2 G
30 s	200 k	60 M	500 k	150 M	1 M	300 M	2 M	600 M	5 M	1.5 G
1 min	100 k	60 M	200 k	120 M	500 k	300 M	1 M	600 M	2 M	1.2 G
2 min	50 k	60 M	200 k	240 M	200 k	240 M	500 k	600 M	1 M	1.2 G
3 min	50 k	90 M	100 k	180 M	200 k	360 M	500 k	900 M	1 M	1.8 G
4 min	20 k	48 M	100 k	240 M	200 k	480 M	200 k	480 M	500 k	1.2 G
5 min	20 k	60 M	50 k	150 M	100 k	300 M	200 k	600 M	500 k	1.5 G
6 min	20 k	72 M	50 k	180 M	100 k	360 M	200 k	720 M	500 k	1.8 G
7 min	20 k	84 M	50 k	210 M	100 k	420 M	200 k	840 M	200 k	840 M
8 min	20 k	96 M	50 k	240 M	100 k	480 M	200 k	960 M	200 k	960 M
9 min	10 k	54 M	20 k	108 M	50 k	270 M	100 k	540 M	200 k	1.08 G
10 min	10 k	60 M	20 k	120 M	50 k	300 M	100 k	600 M	200 k	1.2 G
12 min	10 k	72 M	20 k	144 M	50 k	360 M	100 k	720 M	200 k	1.44 G
15 min	10 k	90 M	20 k	180 M	50 k	450 M	100 k	900 M	200 k	1.8 G
30 min	5 k	90 M	10 k	180 M	20 k	360 M	50 k	900 M	100 k	1.8 G
1 h	2 k	72 M	5 k	180 M	10 k	360 M	20 k	720 M	50 k	1.8 G
2 h	1 k	72 M	2 k	144 M	5 k	360 M	10 k	720 M	20 k	1.44 G
3 h	500	54 M	2 k	216 M	2 k	216 M	5 k	540 M	10 k	1.08 G
4 h	500	72 M	1 k	144 M	2 k	288 M	5 k	720 M	10 k	1.44 G
5 h	500	90 M	1 k	180 M	2 k	360 M	5 k	900 M	10 k	1.8 G
6 h	200	43.2 M	1 k	216 M	2 k	432 M	2 k	432 M	5 k	1.08 G
7 h	200	50.4 M	500	126 M	1 k	252 M	2 k	504 M	5 k	1.26 G
8 h	200	57.6 M	500	144 M	1 k	288 M	2 k	576 M	5 k	1.44 G
9 h	200	64.8 M	500	162 M	1 k	324 M	2 k	648 M	5 k	1.62 G
10 h	200	72 M	500	180 M	1 k	360 M	2 k	720 M	5 k	1.8 G
12 h	200	86.4 M	500	216 M	1 k	432 M	2 k	864 M	2 k	864 M
1 day	100	86.4 M	200	172.8 M	500	432 M	1 k	864 M	2 k	1.728 G
2 days	50	86.4 M	100	172.8 M	200	345.6 M	500	864 M	1 k	1.728 G
3 days	20	51.84 M	50	129.6 M	100	259.2 M	200	518.4 M	500	1.296 G
4 days	20	69.12M	50	172.8M	100	345.6M	200	691.2M	500	1.728G
5 days	20	86.4M	50	216M	100	432M	200	864M	200	864M
6 days	10	51.84M	20	103.68M	50	259.2M	100	518.4M	200	1.0368G
8 days	10	69.12M	20	138.24M	50	345.6M	100	691.2M	200	1.3824G
10 days	10	86.4M	20	172.8M	50	432M	100	864M	200	1.728G
20 days	5	86.4M	10	172.8M	20	345.6M	50	864M	100	1.728G

When the time axis setting is 100 ms or greater (the settings surrounded by bold lines) and the trigger mode is Auto or Auto Level, waveforms are displayed in roll mode.

When the Record Length Is 4 Gpoint, 5 Gpoint, 10 Gpoint, 20 Gpoint, or 50 Gpoint

Time/div	Record Length									
	4 Gpoint		5 Gpoint		10 Gpoint		20 Gpoint		50 Gpoint	
	Sample Rate (S/s)	Display Record Length (Points)	Sample Rate (S/s)	Display Record Length (Points)	Sample Rate (S/s)	Display Record Length (Points)	Sample Rate (S/s)	Display Record Length (Points)	Sample Rate (S/s)	Display Record Length (Points)
100 ns										
200 ns										
500 ns										
1 μs										
2 μs										
5 μs										
10 μs										
20 μs										
50 μs										
100 μs										
200 μs										
500 μs										
1 ms										
2 ms										
5 ms										
10 ms										
20 ms										
50 ms										
100 ms										
200 ms										
500 ms										
1 s										
2 s										
3 s										
4 s										
5 s										
6 s										
8 s										
10 s										
20 s										
30 s										
1 min										
2 min										
3 min										
4 min	1 M	2.4 G								
5 min	1 M	3 G	1 M	3 G						
6 min	1 M	3.6 G	1 M	3.6 G						
7 min	500 k	2.1 G	1 M	4.2 G						
8 min	500 k	2.4 G	1 M	4.8 G						
9 min	500 k	2.7 G	500 k	2.7 G	1 M	5.4 G				
10 min	500 k	3 G	500 k	3 G	1 M	6 G				
12 min	500 k	3.6 G	500 k	3.6 G	1 M	7.2 G				
15 min	200 k	1.8 G	500 k	4.5 G	1 M	9 G				
30 min	200 k	3.6 G	200 k	3.6 G	500 k	9 G	1 M	18 G		
1 h	100 k	3.6 G	100 k	3.6 G	200 k	7.2 G	500 k	18 G	1 M	36 G
2 h	50 k	3.6 G	50 k	3.6 G	100 k	7.2 G	200 k	14.4 G	500 k	36 G
3 h	20 k	2.16 G	20 k	2.16 G	50 k	5.4 G	100 k	10.8 G	200 k	21.6 G
4 h	20 k	2.88 G	20 k	2.88 G	50 k	7.2 G	100 k	14.4 G	200 k	28.8 G
5 h	20 k	3.6 G	20 k	3.6 G	50 k	9 G	100 k	18 G	200 k	36 G

When the time axis setting is 100 ms or greater (the settings surrounded by bold lines) and the trigger mode is Auto or Auto Level, waveforms are displayed in roll mode.

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Time/div	Record Length									
	4 Gpoint		**5 Gpoint**		**10 Gpoint**		**20 Gpoint**		**50 Gpoint**	
	Sample Rate (S/s)	**Display Record Length (Points)**	**Sample Rate (S/s)**	**Display Record Length (Points)**	**Sample Rate (S/s)**	**Display Record Length (Points)**	**Sample Rate (S/s)**	**Display Record Length (Points)**	**Sample Rate (S/s)**	**Display Record Length (Points)**
6 h	10 k	2.16 G	20 k	4.32 G	20 k	4.32 G	50 k	10.8 G	200 k	43.2 G
7 h	10 k	2.52 G	10 k	2.52 G	20 k	5.04 G	50 k	12.6 G	100 k	25.2 G
8 h	10 k	2.88 G	10 k	2.88 G	20 k	5.76 G	50 k	14.4 G	100 k	28.8 G
9 h	10 k	3.24 G	10 k	3.24 G	20 k	6.48 G	50 k	16.2 G	100 k	32.4 G
10 h	10 k	3.6 G	10 k	3.6 G	20 k	7.2 G	50 k	18 G	100 k	36 G
12 h	5 k	2.16 G	10 k	4.32 G	20 k	8.64 G	20 k	8.64 G	100 k	43.2 G
1 day	2 k	1.728 G	5 k	4.32 G	10 k	8.64 G	20 k	17.28 G	50 k	43.2 G
2 days	2 k	3.456 G	2 k	3.456 G	5 k	8.64 G	10 k	17.28 G	20 k	34.56 G
3 days	1 k	2.592 G	1 k	2.592 G	2 k	5.184 G	5 k	12.96 G	10 k	25.9 G
4 days	1 k	3.456G	1 k	3.456G	2 k	6.912G	5 k	17.28G	10 k	34.56G
5 days	500	2.16G	1 k	4.32G	2 k	8.64G	2 k	8.64G	10 k	43.2G
6 days	500	2.592G	500	2.592G	1 k	5.184G	2 k	10.368G	5 k	25.92G
8 days	500	3.456G	500	3.456G	1 k	6.912G	2 k	13.824G	5 k	34.56G
10 days	200	1.728G	500	4.32G	1 k	8.64G	2 k	17.28G	5 k	43.2G
20 days	200	3.456G	200	3.456G	500	8.64G	1 k	17.28G	2 k	34.56G

When the time axis setting is 100 ms or greater (the settings surrounded by bold lines) and the trigger mode is Auto or Auto Level, waveforms are displayed in roll mode.

When the High-Speed 100 MS/s, 12-Bit Isolation Module Is Not Installed

When the Record Length Is 1 kpoint, 2.5 kpoint, 5 kpoint, 10 kpoint, or 25 kpoint

Time/div	Record Length									
	1 kpoint		2.5 kpoint		5 kpoint		10 kpoint		25 kpoint	
	Sample Rate (S/s)	Display Record Length (Points)	Sample Rate (S/s)	Display Record Length (Points)	Sample Rate (S/s)	Display Record Length (Points)	Sample Rate (S/s)	Display Record Length (Points)	Sample Rate (S/s)	Display Record Length (Points)
1 μs	10 M	100	10 M	100	10 M	100	10 M	100	10 M	100
2 μs	10 M	200	10 M	200	10 M	200	10 M	200	10 M	200
5 μs	10 M	500	10 M	500	10 M	500	10 M	500	10 M	500
10 μs	10 M	1 k	10 M	1 k	10 M	1 k	10 M	1 k	10 M	1 k
20 μs	5 M	1 k	10 M	2 k	10 M	2 k	10 M	2 k	10 M	2 k
50 μs	2 M	1 k	5 M	2.5 k	10 M	5 k	10 M	5 k	10 M	5 k
100 μs	1 M	1 k	2 M	2 k	5 M	5 k	10 M	10 k	10 M	10 k
200 μs	500 k	1 k	1 M	2 k	2 M	4 k	5 M	10 k	10 M	20 k
500 μs	200 k	1 k	500 k	2.5 k	1 M	5 k	2 M	10 k	5 M	25 k
1 ms	100 k	1 k	200 k	2 k	500 k	5 k	1 M	10 k	2 M	20 k
2 ms	50 k	1 k	100 k	2 k	200 k	4 k	500 k	10 k	1 M	20 k
5 ms	20 k	1 k	50 k	2.5 k	100 k	5 k	200 k	10 k	500 k	25 k
10 ms	10 k	1 k	20 k	2 k	50 k	5 k	100 k	10 k	200 k	20 k
20 ms	5 k	1 k	10 k	2 k	20 k	4 k	50 k	10 k	100 k	20 k
50 ms	2 k	1 k	5 k	2.5 k	10 k	5 k	20 k	10 k	50 k	25 k
100 ms	1 k	1 k	2 k	2 k	5 k	5 k	10 k	10 k	20 k	20 k
200 ms	500	1 k	1 k	2 k	2 k	4 k	5 k	10 k	10 k	20 k
500 ms	200	1 k	500	2.5 k	1 k	5 k	2 k	10 k	5 k	25 k
1 s	100	1 k	200	2 k	500	5 k	1 k	10 k	2 k	20 k
2 s	50	1 k	100	2 k	200	4 k	500	10 k	1 k	20 k
3 s	20	600	50	1.5 k	100	3 k	200	6 k	500	15 k
4 s	20	800	50	2 k	100	4 k	200	8 k	500	20 k
5 s	20	1 k	50	2.5 k	100	5 k	200	10 k	500	25 k
6 s	10	600	20	1.2 k	50	3 k	100	6 k	200	12 k
8 s	10	800	20	1.6 k	50	4 k	100	8 k	200	16 k
10 s	10	1 k	20	2 k	50	5 k	100	10 k	200	20 k
20 s	5	1 k	10	2 k	20	4 k	50	10 k	100	20 k
30 s			5	1.5 k	10	3 k	20	6 k	50	15 k
1 min					5	3 k	10	6 k	20	12 k
2 min							5	6 k	20	24 k
3 min							5	9 k	10	18 k
4 min									10	24 k
5 min									5	15 k
6 min									5	18 k
7 min									5	21 k

When the time axis setting is 100 ms or greater (the settings surrounded by bold lines) and the trigger mode is Auto or Auto Level, waveforms are displayed in roll mode.

When the Record Length Is 50 kpoint, 100 kpoint, 250 kpoint, 500 kpoint, or 1 Mpoint

Time/div	Record Length									
	50 kpoint		100 kpoint		250 kpoint		500 kpoint		1 Mpoint	
	Sample Rate (S/s)	Display Record Length (Points)	Sample Rate (S/s)	Display Record Length (Points)	Sample Rate (S/s)	Display Record Length (Points)	Sample Rate (S/s)	Display Record Length (Points)	Sample Rate (S/s)	Display Record Length (Points)
1 µs	10 M	100	10 M	100	10 M	100	10 M	100	10 M	100
2 µs	10 M	200	10 M	200	10 M	200	10 M	200	10 M	200
5 µs	10 M	500	10 M	500	10 M	500	10 M	500	10 M	500
10 µs	10 M	1 k	10 M	1 k	10 M	1 k	10 M	1 k	10 M	1 k
20 µs	10 M	2 k	10 M	2 k	10 M	2 k	10 M	2 k	10 M	2 k
50 µs	10 M	5 k	10 M	5 k	10 M	5 k	10 M	5 k	10 M	5 k
100 µs	10 M	10 k	10 M	10 k	10 M	10 k	10 M	10 k	10 M	10 k
200 µs	10 M	20 k	10 M	20 k	10 M	20 k	10 M	20 k	10 M	20 k
500 µs	10 M	50 k	10 M	50 k	10 M	50 k	10 M	50 k	10 M	50 k
1 ms	5 M	50 k	10 M	100 k	10 M	100 k	10 M	100 k	10 M	100 k
2 ms	2 M	40 k	5 M	100 k	10 M	200 k	10 M	200 k	10 M	200 k
5 ms	1 M	50 k	2 M	100 k	5 M	250 k	10 M	500 k	10 M	500 k
10 ms	500 k	50 k	1 M	100 k	2 M	200 k	5 M	500 k	10 M	1 M
20 ms	200 k	40 k	500 k	100 k	1 M	200 k	2 M	400 k	5 M	1 M
50 ms	100 k	50 k	200 k	100 k	500 k	250 k	1 M	500 k	2 M	1 M
100 ms	50 k	50 k	100 k	100 k	200 k	200 k	500 k	500 k	1 M	1 M
200 ms	20 k	40 k	50 k	100 k	100 k	200 k	200 k	400 k	500 k	1 M
500 ms	10 k	50 k	20 k	100 k	50 k	250 k	100 k	500 k	200 k	1 M
1 s	5 k	50 k	10 k	100 k	20 k	200 k	50 k	500 k	100 k	1 M
2 s	2 k	40 k	5 k	100 k	10 k	200 k	20 k	400 k	50 k	1 M
3 s	1 k	30 k	2 k	60 k	5 k	150 k	10 k	300 k	20 k	600 k
4 s	1 k	40 k	2 k	80 k	5 k	200 k	10 k	400 k	20 k	800 k
5 s	1 k	50 k	2 k	100 k	5 k	250 k	10 k	500 k	20 k	1 M
6 s	500	30 k	1 k	60 k	2 k	120 k	5 k	300 k	10 k	600 k
8 s	500	40 k	1 k	80 k	2 k	160 k	5 k	400 k	10 k	800 k
10 s	500	50 k	1 k	100 k	2 k	200 k	5 k	500 k	10 k	1 M
20 s	200	40 k	500	100 k	1 k	200 k	2 k	400 k	5 k	1 M
30 s	100	30 k	200	60 k	500	150 k	1 k	300 k	2 k	600 k
1 min	50	30 k	100	60 k	200	120 k	500	300 k	1 k	600 k
2 min	20	24 k	50	60 k	200	240 k	200	240 k	500	600 k
3 min	20	36 k	50	90 k	100	180 k	200	360 k	500	900 k
4 min	20	48 k	20	48 k	100	240 k	200	480 k	200	480 k
5 min	10	30 k	20	60 k	50	150 k	100	300 k	200	600 k
6 min	10	36 k	20	72 k	50	180 k	100	360 k	200	720 k
7 min	10	42 k	20	84 k	50	210 k	100	420 k	200	840 k
8 min	10	48 k	20	96 k	50	240 k	100	480 k	200	960 k
9 min	5	27 k	10	54 k	20	108 k	50	270 k	100	540 k
10 min	5	30 k	10	60 k	20	120 k	50	300 k	100	600 k
12 min	5	36 k	10	72 k	20	144 k	50	360 k	100	720 k
15 min	5	45 k	10	90 k	20	180 k	50	450 k	100	900 k
30 min			5	90 k	10	180 k	20	360 k	50	900 k
1 h					5	180 K	10	360 k	20	720 k
2 h							5	360 k	10	720 k
3 h									5	540 k
4 h									5	720 k
5 h									5	900 k

When the time axis setting is 100 ms or greater (the settings surrounded by bold lines) and the trigger mode is Auto or Auto Level, waveforms are displayed in roll mode.

When the Record Length Is 2.5 Mpoint, 5 Mpoint, 10 Mpoint, 25 Mpoint, or 50 Mpoint

Time/div	Record Length									
	2.5 Mpoint		5 Mpoint		10 Mpoint		25 Mpoint		50 Mpoint	
	Sample Rate (S/s)	Display Record Length (Points)	Sample Rate (S/s)	Display Record Length (Points)	Sample Rate (S/s)	Display Record Length (Points)	Sample Rate (S/s)	Display Record Length (Points)	Sample Rate (S/s)	Display Record Length (Points)
1 μs	10 M	100	10 M	100	10 M	100	10 M	100	10 M	100
2 μs	10 M	200	10 M	200	10 M	200	10 M	200	10 M	200
5 μs	10 M	500	10 M	500	10 M	500	10 M	500	10 M	500
10 μs	10 M	1 k	10 M	1 k	10 M	1 k	10 M	1 k	10 M	1 k
20 μs	10 M	2 k	10 M	2 k	10 M	2 k	10 M	2 k	10 M	2 k
50 μs	10 M	5 k	10 M	5 k	10 M	5 k	10 M	5 k	10 M	5 k
100 μs	10 M	10 k	10 M	10 k	10 M	10 k	10 M	10 k	10 M	10 k
200 μs	10 M	20 k	10 M	20 k	10 M	20 k	10 M	20 k	10 M	20 k
500 μs	10 M	50 k	10 M	50 k	10 M	50 k	10 M	50 k	10 M	50 k
1 ms	10 M	100 k	10 M	100 k	10 M	100 k	10 M	100 k	10 M	100 k
2 ms	10 M	200 k	10 M	200 k	10 M	200 k	10 M	200 k	10 M	200 k
5 ms	10 M	500 k	10 M	500 k	10 M	500 k	10 M	500 k	10 M	500 k
10 ms	10 M	1 M	10 M	1 M	10 M	1 M	10 M	1 M	10 M	1 M
20 ms	10 M	2 M	10 M	2 M	10 M	2 M	10 M	2 M	10 M	2 M
50 ms	5 M	2.5 M	10 M	5 M	10 M	5 M	10 M	5 M	10 M	5 M
100 ms	2 M	2 M	5 M	5 M	10 M	10 M	10 M	10 M	10 M	10 M
200 ms	1 M	2 M	2 M	4 M	5 M	10 M	10 M	20 M	10 M	20 M
500 ms	500 k	2.5 M	1 M	5 M	2 M	10 M	5 M	25 M	10 M	50 M
1 s	200 k	2 M	500 k	5 M	1 M	10 M	2 M	20 M	5 M	50 M
2 s	100 k	2 M	200 k	4 M	500 k	10 M	1 M	20 M	2 M	40 M
3 s	50 k	1.5 M	100 k	3 M	200 k	6 M	500 k	15 M	1 M	30 M
4 s	50 k	2 M	100 k	4 M	200 k	8 M	500 k	20 M	1 M	40 M
5 s	50 k	2.5 M	100 k	5 M	200 k	10 M	500 k	25 M	1 M	50 M
6 s	20 k	1.2 M	50 k	3 M	100 k	6 M	200 k	12 M	500 k	30 M
8 s	20 k	1.6 M	50 k	4 M	100 k	8 M	200 k	16 M	500 k	40 M
10 s	20 k	2 M	50 k	5 M	100 k	10 M	200 k	20 M	500 k	50 M
20 s	10 k	2 M	20 k	4 M	50 k	10 M	100 k	20 M	200 k	40 M
30 s	5 k	1.5 M	10 k	3 M	20 k	6 M	50 k	15 M	100 k	30 M
1 min	2 k	1.2 M	5 k	3 M	10 k	6 M	20 k	12 M	50 k	30 M
2 min	2 k	2.4 M	2 k	2.4 M	5 k	6 M	20 k	24 M	20 k	24 M
3 min	1 k	1.8 M	2 k	3.6 M	5 k	9 M	10 k	18 M	20 k	36 M
4 min	1 k	2.4 M	2 k	4.8 M	2 k	4.8 M	10 k	24 M	20 k	48 M
5 min	500	1.5 M	1 k	3 M	2 k	6 M	5 k	15 M	10 k	30 M
6 min	500	1.8 M	1 k	3.6 M	2 k	7.2 M	5 k	18 M	10 k	36 M
7 min	500	2.1 M	1 k	4.2 M	2 k	8.4 M	5 k	21 M	10 k	42 M
8 min	500	2.4 M	1 k	4.8 M	2 k	9.6 M	5 k	24 M	10 k	48 M
9 min	200	1.08 M	500	2.7 M	1 k	5.4 M	2 k	10.8 M	5 k	27 M
10 min	200	1.2 M	500	3 M	1 k	6 M	2 k	12 M	5 k	30 M
12 min	200	1.44 M	500	3.6 M	1 k	7.2 M	2 k	14.4 M	5 k	36 M
15 min	200	1.8 M	500	4.5 M	1 k	9 M	2 k	18 M	5 k	45 M
30 min	100	1.8 M	200	3.6 M	500	9 M	1 k	18 M	2 k	36 M
1 h	50	1.8 M	100	3.6 M	200	7.2 M	500	18 M	1 k	36 M
2 h	20	1.44 M	50	3.6 M	100	7.2 M	200	14.4 M	500	36 M
3 h	20	2.16 M	20	2.16 M	50	5.4 M	200	21.6 M	200	21.6 M
4 h	10	1.44 M	20	2.88 M	50	7.2 M	100	14.4 M	200	28.8 M
5 h	10	1.8 M	20	3.6 M	50	9 M	100	18 M	200	36 M
6 h	10	2.16 M	20	4.32 M	20	4.32 M	100	21.6 M	200	43.2 M
7 h	5	1.26 M	10	2.52 M	20	5.04 M	50	12.6 M	100	25.2 M
8 h	5	1.44 M	10	2.88 M	20	5.76 M	50	14.4 M	100	28.8 M
9 h	5	1.62 M	10	3.24 M	20	6.48 M	50	16.2 M	100	32.4 M
10 h	5	1.8 M	10	3.6 M	20	7.2 M	50	18 M	100	36 M
12 h	5	2.16 M	10	4.32 M	20	8.64 M	50	21.6 M	100	43.2 M
1 day			5	4.32 M	10	8.64 M	20	17.28 M	50	43.2 M
2 days					5	8.64 M	10	17.28 M	20	34.56 M
3 days							5	12.96 M	10	25.92 M

When the time axis setting is 100 ms or greater (the settings surrounded by bold lines) and the trigger mode is Auto or Auto Level, waveforms are displayed in roll mode.

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	Record Length									
	2.5 Mpoint		**5 Mpoint**		**10 Mpoint**		**25 Mpoint**		**50 Mpoint**	
Time/div	**Sample Rate (S/s)**	**Display Record Length (Points)**	**Sample Rate (S/s)**	**Display Record Length (Points)**	**Sample Rate (S/s)**	**Display Record Length (Points)**	**Sample Rate (S/s)**	**Display Record Length (Points)**	**Sample Rate (S/s)**	**Display Record Length (Points)**
4 days							5	17.28M	10	34.56M
5 days							5	21.6M	10	43.2M
6 days									5	25.92M
8 days									5	34.56M
10 days									5	43.2M

When the time axis setting is 100 ms or greater (the settings surrounded by bold lines) and the trigger mode is Auto or Auto Level, waveforms are displayed in roll mode.

When the Record Length Is 100 Mpoint, 250 Mpoint, 500 Mpoint, 1 Gpoint, or 2 Gpoint

Time/div	Record Length									
	100 Mpoint		250 Mpoint		500 Mpoint		1 Gpoint		2 Gpoint	
	Sample Rate (S/s)	Display Record Length (Points)	Sample Rate (S/s)	Display Record Length (Points)	Sample Rate (S/s)	Display Record Length (Points)	Sample Rate (S/s)	Display Record Length (Points)	Sample Rate (S/s)	Display Record Length (Points)
1 μs	10 M	100	10 M	100	10 M	100	10 M	100	10 M	100
2 μs	10 M	200	10 M	200	10 M	200	10 M	200	10 M	200
5 μs	10 M	500	10 M	500	10 M	500	10 M	500	10 M	500
10 μs	10 M	1 k	10 M	1 k	10 M	1 k	10 M	1 k	10 M	1 k
20 μs	10 M	2 k	10 M	2 k	10 M	2 k	10 M	2 k	10 M	2 k
50 μs	10 M	5 k	10 M	5 k	10 M	5 k	10 M	5 k	10 M	5 k
100 μs	10 M	10 k	10 M	10 k	10 M	10 k	10 M	10 k	10 M	10 k
200 μs	10 M	20 k	10 M	20 k	10 M	20 k	10 M	20 k	10 M	20 k
500 μs	10 M	50 k	10 M	50 k	10 M	50 k	10 M	50 k	10 M	50 k
1 ms	10 M	100 k	10 M	100 k	10 M	100 k	10 M	100 k	10 M	100 k
2 ms	10 M	200 k	10 M	200 k	10 M	200 k	10 M	200 k	10 M	200 k
5 ms	10 M	500 k	10 M	500 k	10 M	500 k	10 M	500 k	10 M	500 k
10 ms	10 M	1 M	10 M	1 M	10 M	1 M	10 M	1 M	10 M	1 M
20 ms	10 M	2 M	10 M	2 M	10 M	2 M	10 M	2 M	10 M	2 M
50 ms	10 M	5 M	10 M	5 M	10 M	5 M	10 M	5 M	10 M	5 M
100 ms	10 M	10 M	10 M	10 M	10 M	10 M	10 M	10 M	10 M	10 M
200 ms	10 M	20 M	10 M	20 M	10 M	20 M	10 M	20 M	10 M	20 M
500 ms	10 M	50 M	10 M	50 M	10 M	50 M	10 M	50 M	10 M	50 M
1 s	10 M	100 M	10 M	100 M	10 M	100 M	10 M	100 M	10 M	100 M
2 s	5 M	100 M	10 M	200 M	10 M	200 M	10 M	200 M	10 M	200 M
3 s	2 M	60 M	5 M	150 M	10 M	300 M	10 M	300 M	10 M	300 M
4 s	2 M	80 M	5 M	200 M	10 M	400 M	10 M	400 M	10 M	400 M
5 s	2 M	100 M	5 M	250 M	10 M	500 M	10 M	500 M	10 M	500 M
6 s	1 M	60 M	2 M	120 M	5 M	300 M	10 M	600 M	10 M	600 M
8 s	1 M	80 M	2 M	160 M	5 M	400 M	10 M	800 M	10 M	800 M
10 s	1 M	100 M	2 M	200 M	5 M	500 M	10 M	1 G	10 M	1 G
20 s	500 k	100 M	1 M	200 M	2 M	400 M	5 M	1 G	10 M	2 G
30 s	200 k	60 M	500 k	150 M	1 M	300 M	2 M	600 M	5 M	1.5 G
1 min	100 k	60 M	200 k	120 M	500 k	300 M	1 M	600 M	2 M	1.2 G
2 min	50 k	60 M	200 k	240 M	200 k	240 M	500 k	600 M	1 M	1.2 G
3 min	50 k	90 M	100 k	180 M	200 k	360 M	500 k	900 M	1 M	1.8 G
4 min	20 k	48 M	100 k	240 M	200 k	480 M	200 k	480 M	500 k	1.2 G
5 min	20 k	60 M	50 k	150 M	100 k	300 M	200 k	600 M	500 k	1.5 G
6 min	20 k	72 M	50 k	180 M	100 k	360 M	200 k	720 M	500 k	1.8 G
7 min	20 k	84 M	50 k	210 M	100 k	420 M	200 k	840 M	200 k	840 M
8 min	20 k	96 M	50 k	240 M	100 k	480 M	200 k	960 M	200 k	960 M
9 min	10 k	54 M	20 k	108 M	50 k	270 M	100 k	540 M	200 k	1.08 G
10 min	10 k	60 M	20 k	120 M	50 k	300 M	100 k	600 M	200 k	1.2 G
12 min	10 k	72 M	20 k	144 M	50 k	360 M	100 k	720 M	200 k	1.44 G
15 min	10 k	90 M	20 k	180 M	50 k	450 M	100 k	900 M	200 k	1.8 G
30 min	5 k	90 M	10 k	180 M	20 k	360 M	50 k	900 M	100 k	1.8 G
1 h	2 k	72 M	5 k	180 M	10 k	360 M	20 k	720 M	50 k	1.8 G
2 h	1 k	72 M	2 k	144 M	5 k	360 M	10 k	720 M	20 k	1.44 G
3 h	500	54 M	2 k	216 M	2 k	216 M	5 k	540 M	10 k	1.08 G
4 h	500	72 M	1 k	144 M	2 k	288 M	5 k	720 M	10 k	1.44 G
5 h	500	90 M	1 k	180 M	2 k	360 M	5 k	900 M	10 k	1.8 G
6 h	200	43.2 M	1 k	216 M	2 k	432 M	2 k	432 M	5 k	1.08 G
7 h	200	50.4 M	500	126 M	1 k	252 M	2 k	504 M	5 k	1.26 G
8 h	200	57.6 M	500	144 M	1 k	288 M	2 k	576 M	5 k	1.44 G
9 h	200	64.8 M	500	162 M	1 k	324 M	2 k	648 M	5 k	1.62 G
10 h	200	72 M	500	180 M	1 k	360 M	2 k	720 M	5 k	1.8 G
12 h	200	86.4 M	500	216 M	1 k	432 M	2 k	864 M	2 k	864 M
1 day	100	86.4 M	200	172.8 M	500	432 M	1 k	864 M	2 k	1.728 G
2 days	50	86.4 M	100	172.8 M	200	345.6 M	500	864 M	1 k	1.728 G
3 days	20	51.84 M	50	129.6 M	100	259.2 M	200	518.4 M	500	1.296 G

When the time axis setting is 100 ms or greater (the settings surrounded by bold lines) and the trigger mode is Auto or Auto Level, waveforms are displayed in roll mode.

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	Record Length									
	100 Mpoint		250 Mpoint		500 Mpoint		1 Gpoint		2 Gpoint	
Time/div	Sample Rate (S/s)	Display Record Length (Points)	Sample Rate (S/s)	Display Record Length (Points)	Sample Rate (S/s)	Display Record Length (Points)	Sample Rate (S/s)	Display Record Length (Points)	Sample Rate (S/s)	Display Record Length (Points)
4 days	20	69.12M	50	172.8M	100	345.6M	200	691.2M	500	1.728G
5 days	20	86.4M	50	216M	100	432M	200	864M	200	864M
6 days	10	51.84M	20	103.68M	50	259.2M	100	518.4M	200	1.0368G
8 days	10	69.12M	20	138.24M	50	345.6M	100	691.2M	200	1.3824G
10 days	10	86.4M	20	172.8M	50	432M	100	864M	200	1.728G
20 days	5	86.4M	10	172.8M	20	345.6M	50	864M	100	1.728G

When the time axis setting is 100 ms or greater (the settings surrounded by bold lines) and the trigger mode is Auto or Auto Level, waveforms are displayed in roll mode.

When the Record Length Is 4 Gpoint, 5 Gpoint, 10 Gpoint, 20 Gpoint, or 50 Gpoint

Time/div	Record Length									
	4 Gpoint		5 Gpoint		10 Gpoint		20 Gpoint		50 Gpoint	
	Sample Rate (S/s)	Display Record Length (Points)	Sample Rate (S/s)	Display Record Length (Points)	Sample Rate (S/s)	Display Record Length (Points)	Sample Rate (S/s)	Display Record Length (Points)	Sample Rate (S/s)	Display Record Length (Points)
1 µs										
2 µs										
5 µs										
10 µs										
20 µs										
50 µs										
100 µs										
200 µs										
500 µs										
1 ms										
2 ms										
5 ms										
10 ms										
20 ms										
50 ms										
100 ms										
200 ms										
500 ms										
1 s										
2 s										
3 s										
4 s										
5 s										
6 s										
8 s										
10 s										
20 s										
30 s										
1 min										
2 min										
3 min										
4 min	1 M	2.4 G								
5 min	1 M	3 G	1 M	3 G						
6 min	1 M	3.6 G	1 M	3.6 G						
7 min	500 k	2.1 G	1 M	4.2 G						
8 min	500 k	2.4 G	1 M	4.8 G						
9 min	500 k	2.7 G	500 k	2.7 G	1 M	5.4 G				
10 min	500 k	3 G	500 k	3 G	1 M	6 G				
12 min	500 k	3.6 G	500 k	3.6 G	1 M	7.2 G				
15 min	200 k	1.8 G	500 k	4.5 G	1 M	9 G				
30 min	200 k	3.6 G	200 k	3.6 G	500 k	9 G	1 M	18 G		
1 h	100 k	3.6 G	100 k	3.6 G	200 k	7.2 G	500 k	18 G	1 M	36 G
2 h	50 k	3.6 G	50 k	3.6 G	100 k	7.2 G	200 k	14.4 G	500 k	36 G
3 h	20 k	2.16 G	20 k	2.16 G	50 k	5.4 G	100 k	10.8 G	200 k	21.6 G
4 h	20 k	2.88 G	20 k	2.88 G	50 k	7.2 G	100 k	14.4 G	200 k	28.8 G
5 h	20 k	3.6 G	20 k	3.6 G	50 k	9 G	100 k	18 G	200 k	36 G
6 h	10 k	2.16 G	20 k	4.32 G	20 k	4.32 G	50 k	10.8 G	200 k	43.2 G
7 h	10 k	2.52 G	10 k	2.52 G	20 k	5.04 G	50 k	12.6 G	100 k	25.2 G
8 h	10 k	2.88 G	10 k	2.88 G	20 k	5.76 G	50 k	14.4 G	100 k	28.8 G
9 h	10 k	3.24 G	10 k	3.24 G	20 k	6.48 G	50 k	16.2 G	100 k	32.4 G
10 h	10 k	3.6 G	10 k	3.6 G	20 k	7.2 G	50 k	18 G	100 k	36 G
12 h	5 k	2.16 G	10 k	4.32 G	20 k	8.64 G	20 k	8.64 G	100 k	43.2 G
1 day	2 k	1.728 G	5 k	4.32 G	10 k	8.64 G	20 k	17.28 G	50 k	43.2 G
2 days	2 k	3.456 G	2 k	3.456 G	5 k	8.64 G	10 k	17.28 G	20 k	34.56 G
3 days	1 k	2.592 G	1 k	2.592 G	2 k	5.184 G	5 k	12.96 G	10 k	25.9 G

When the time axis setting is 100 ms or greater (the settings surrounded by bold lines) and the trigger mode is Auto or Auto Level, waveforms are displayed in roll mode.

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	Record Length									
	4 Gpoint		5 Gpoint		10 Gpoint		20 Gpoint		50 Gpoint	
Time/div	Sample Rate (S/s)	Display Record Length (Points)	Sample Rate (S/s)	Display Record Length (Points)	Sample Rate (S/s)	Display Record Length (Points)	Sample Rate (S/s)	Display Record Length (Points)	Sample Rate (S/s)	Display Record Length (Points)
4 days	1 k	3.456G	1 k	3.456G	2 k	6.912G	5 k	17.28G	10 k	34.56G
5 days	500	2.16G	1 k	4.32G	2 k	8.64G	2 k	8.64G	10 k	43.2G
6 days	500	2.592G	500	2.592G	1 k	5.184G	2 k	10.368G	5 k	25.92G
8 days	500	3.456G	500	3.456G	1 k	6.912G	2 k	13.824G	5 k	34.56G
10 days	200	1.728G	500	4.32G	1 k	8.64G	2 k	17.28G	5 k	43.2G
20 days	200	3.456G	200	3.456G	500	8.64G	1 k	17.28G	2 k	34.56G

When the time axis setting is 100 ms or greater (the settings surrounded by bold lines) and the trigger mode is Auto or Auto Level, waveforms are displayed in roll mode.

Relationship between the Main Channel Sample Rate and the Sub Channel Sample Rates of the 16-CH Voltage Input Module

Main Channel Sample Rate (S/s)	Number of Sub Channels				
	1	2	3 to 4	5 to 8	9 to 16
	Maximum Sample Rate				
	200 k	100 k	50 k	20 k	10 k
100 M	500 k	500 k	500 k	500 k	500 k
50 M	500 k	500 k	500 k	500 k	500 k
20 M	500 k	500 k	500 k	500 k	500 k
10 M	500 k	500 k	500 k	500 k	500 k
5 M	500 k	500 k	500 k	500 k	200 k
2 M	500 k	500 k	500 k	200 k	100 k
1 M	500 k	500 k	200 k	100 k	50 k
500 k	500 k	100 k	100 k	50 k	20 k
200 k	200 k	100 k	50 k	20 k	10 k
100 k	100 k	50 k	20 k	10 k	5 k
50 k	50 k	10 k	10 k	5 k	2 k
20 k	20 k	10 k	5 k	2 k	1 k
10 k	10 k	5 k	2 k	1 k	500
5 k	5 k	1 k	1 k	500	200
2 k	2 k	1 k	500	200	100
1 k	1 k	500	200	100	50
500	500	100	100	50	20
200	200	100	50	20	10
100	100	50	20	10	5
50	50	10	10	5	2
20	20	10	5	2	1
10	10	5	2	1	-
5	5	1	1	-	-

If you set the sample rate (the main channel sample rate) of the DL850E/DL850EV to a rate that is higher than a module's maximum sample rate, because the data is only updated at the module's maximum sample rate, all the data within the module's data update interval will be the same. The thick lines surround the actual sampling ranges. In these ranges, because data is sampled at the module's maximum sample rate, data is updated at every sampling operation.

Relationship between the Main Channel Sample Rate and the Sub Channel Sample Rates of the 16-CH Temperature/Voltage Input Module

Main Channel Sample Rate (S/s)	**Number of Sub Channels:1 to 16**
	Maximum Sample Rate:10 k
100 M	100 k
50 M	100 k
20 M	100 k
10 M	100 k
5 M	100 k
2 M	100 k
1 M	50 k
500 k	20 k
200 k	10 k
100 k	5 k
50 k	2 k
20 k	1 k
10 k	500
5 k	200
2 k	100
1 k	50
500	20
200	10
100	5
50	2
20	1
10	-
5	-

If you set the sample rate (the main channel sample rate) of the DL850E/DL850EV to a rate that is higher than a module's maximum sample rate, because the data is only updated at the module's maximum sample rate, all the data within the module's data update interval will be the same.

Relationship between the Main Channel Sample Rate and the Sub Channel Sample Rates of the CAN Bus Monitor Module

Main Channel Sample Rate (S/s)	Number of Sub Channels						
	1	2	3 to 4	5 to 8	9 to 16	17 to 32[1]	33 to 60[1]
	Maximum Sample Rate						
	100 k	**100 k**	**100 k**	**100 k**	**100 k**	**100 k**	**100 k**
100 M	100 k	100 k	100 k	100 k	100 k	100 k	100 k
50 M	100 k	100 k	100 k	100 k	100 k	100 k	100 k
20 M	100 k	100 k	100 k	100 k	100 k	100 k	100 k
10 M	100 k	100 k	100 k	100 k	100 k	100 k	100 k
5 M	100 k	100 k	100 k	100 k	100 k	100 k	50 k
2 M	100 k	100 k	100 k	100 k	100 k	50 k	20 k
1 M	100 k	100 k	100 k	100 k	50 k	20 k	10 k
500 k	100 k	100 k	100 k	50 k	20 k	10 k	5 k
200 k	100 k	100 k	50 k	20 k	10 k	5 k	2 k
100 k	100 k	50 k	20 k	10 k	5 k	2 k	1 k
50 k	50 k	10 k	10 k	5 k	2 k	1 k	500
20 k	20 k	10 k	5 k	2 k	1 k	500	200
10 k	10 k	5 k	2 k	1 k	500	200	100
5 k	5 k	1 k	1 k	500	200	100	50
2 k	2 k	1 k	500	200	100	50	20
1 k	1 k	500	200	100	50	20	10
500	500	100	100	50	20	10	5
200	200	100	50	20	10	5	2
100	100	50	20	10	5	2	1
50	50	10	10	5	2	1	-
20	20	10	5	2	1	-	-
10	10	5	2	1	-	-	-
5	5	1	1	-	-	-	-

[1] This features covers firmware versions 1.30 and later of the DL850E/DL850EV.

Relationship between the Main Channel Sample Rate and the Sub Channel Sample Rates of the CAN & LIN Bus Monitor Module

Main Channel Sample Rate (S/s)	**Number of Sub Channels**						
	1	**2**	**3 to 4**	**5 to 8**	**9 to 16**	**17 to 32[1]**	**33 to 60[1]**
	Maximum Sample Rate						
	100 k	**100 k**	**100 k**	**100 k**	**100 k**	**100 k**	**100 k**
100 M	100 k	100 k	100 k	100 k	100 k	100 k	100 k
50 M	100 k	100 k	100 k	100 k	100 k	100 k	100 k
20 M	100 k	100 k	100 k	100 k	100 k	100 k	100 k
10 M	100 k	100 k	100 k	100 k	100 k	100 k	100 k
5 M	100 k	100 k	100 k	100 k	100 k	100 k	50 k
2 M	100 k	100 k	100 k	100 k	100 k	50 k	20 k
1 M	100 k	100 k	100 k	100 k	50 k	20 k	10 k
500 k	100 k	100 k	100 k	50 k	20 k	10 k	5 k
200 k	100 k	100 k	50 k	20 k	10 k	5 k	2 k
100 k	100 k	50 k	20 k	10 k	5 k	2 k	1 k
50 k	50 k	10 k	10 k	5 k	2 k	1 k	500
20 k	20 k	10 k	5 k	2 k	1 k	500	200
10 k	10 k	5 k	2 k	1 k	500	200	100
5 k	5 k	1 k	1 k	500	200	100	50
2 k	2 k	1 k	500	200	100	50	20
1 k	1 k	500	200	100	50	20	10
500	500	100	100	50	20	10	5
200	200	100	50	20	10	5	2
100	100	50	20	10	5	2	1
50	50	10	10	5	2	1	-
20	20	10	5	2	1	-	-
10	10	5	2	1	-	-	-
5	5	1	1	-	-	-	-

Appendix 2 Relationship between the Record Length and the Acquisition Mode

Maximum Record Length That Can Be Set

The maximum record length varies as indicated below for each model depending on the number of displayed channels.

When Dual Capturing and Hard Disk Recording Are Off

	Model		
Number of Displayed Channels	**Standard**	**/M1 (1 G)**	**/M2 (2 G)**
9 to 16 channels	10 M	50 M	100 M
5 to 8 channels	25 M	100 M	250 M
3 to 4 channels	50 M	250 M	500 M
2 channels	100 M	500 M	1 G
1 channel	250 M	1 G	2 G

Unit of record length: Point

When Dual Capturing Is Off and Hard Disk Recording Is On

	Model		
Number of Displayed Channels	**Standard**	**/M1 (1 G)**	**/M2 (2 G)**
9 to 16 channels	500 M	2 G	5 G
5 to 8 channels	1 G	5 G	10 G
3 to 4 channels	2 G	10 G	20 G
2 channels	5 G	20 G	20 G
1 channel	10 G	20 G	50 G

Unit of record length: Point

When Dual Capturing Is On and Hard Disk Recording Is Off

	Model		
Number of Displayed Channels	**Standard**	**/M1 (1 G)**	**/M2 (2 G)**
9 to 16 channels	5 M	25 M	50 M
5 to 8 channels	10 M	50 M	100 M
3 to 4 channels	25 M	100 M	250 M
2 channels	50 M	250 M	500 M
1 channel	100 M	500 M	1 G

Unit of record length: Point

When Dual Capturing and Hard Disk Recording Are On

	Model		
Number of Displayed Channels	**Standard**	**/M1 (1 G)**	**/M2 (2 G)**
9 to 16 channels	500 M	2 G	5 G
5 to 8 channels	1 G	5 G	10 G
3 to 4 channels	2 G	10 G	20 G
2 channels	5 G	20 G	20 G
1 channel	10 G	20 G	50 G

Unit of record length: Point

Maximum Number of History Waveform Acquisitions

The maximum number of acquisitions varies for each module as indicated below.

	Model		
Record Length	**Standard**	**/M1 (1 G)**	**/M2 (2 G)**
1 k	5000	5000	5000
2.5 k	5000	5000	5000
5 k	2976	5000	5000
10 k	1487	5000	5000
25 k	593	2381	5000
50 k	295	1189	2381
100 k	144	583	1168
250 k	57	236	474
500 k	28	116	235
1 M	13	54	111
2.5 M	4	22	46
5 M	1	10	22
10 M	1	4	10
25 M	1[1]	1	3
50 M	1[2]	1	1
100 M	1[3]	1[1]	1
250 M	1[4]	1[2]	1[1]
500 M	0	1[3]	1[2]
1 G	0	1[4]	1[3]
2 G	0	0	1[4]

Unit of record length: Point

1 When there are eight displayed channels

2 When there are four displayed channels

3 When there are two displayed channels

4 When there is one displayed channel

Maximum Sample Rate at Which Hard Disk Recording Is Possible

The maximum sample rate varies as indicated below depending on the number of channels that are recorded.

Maximum Number of Channels	Maximum Sample Rate
16 channels	100 kS/s
8 channels	200 kS/s
3 channels	500 kS/s
1 channel	1 MS/s

Dual Capture Count

The dual capture count varies depending on the maximum number of main waveform capturing channels and the record length of DCAP waveforms as shown below.

Record length of DCAP waveforms	Maximum number of main waveform capturing channels	Standard Model		/M1 Model		/M2 Model	
		HD Recording Off	HD Recording On	HD Recording Off	HD Recording On	HD Recording Off	HD Recording On
5k	16	1488	743	5000	2977	5000	5000
10k		743	371	2977	1488	5000	2977
25k		296	147	1190	594	2382	1190
50k		147	73	594	296	1190	594
100k		72	35	291	145	584	291
250k		28	13	118	58	237	118
500k		13	6	58	28	117	58
5k	8	2977	743	5000	2977	5000	5000
10k		1488	371	5000	1488	5000	2977
25k		594	147	2382	594	4765	1190
50k		296	73	1190	296	2382	594
100k		145	35	584	145	1169	291
250k		58	13	237	58	475	118
500k		28	6	117	28	236	58
5k	4	5000	743	5000	2977	5000	5000
10k		2977	371	5000	1488	5000	2977
25k		1190	147	4765	594	5000	1190
50k		594	73	2382	296	4765	594
100k		291	35	1169	145	2339	291
250k		118	13	475	58	952	118
500k		58	6	236	28	473	58
5k	2	5000	743	5000	2977	5000	5000
10k		5000	371	5000	1488	5000	2977
25k		2382	147	5000	594	5000	1190
50k		1190	73	4765	296	5000	594
100k		584	35	2339	145	4680	291
250k		237	13	952	58	1905	118
500k		117	6	473	28	948	58
5k	1	5000	743	5000	2977	5000	5000
10k		5000	371	5000	1488	5000	2977
25k		4765	147	5000	594	5000	1190
50k		2382	73	5000	296	5000	594
100k		1169	35	4680	145	5000	291
250k		475	13	1905	58	3812	118
500k		236	6	948	28	1898	58

Appendix 3 Default Values

Operation Key	Soft Key	Setting
CH1 to 16 (HS10M12 (701250))		
	V/div	50.0 V/div
	Position	0.00 div
	Label	Channel number
	Coupling	DC
	Probe	10:1
	BandWidth	Full
	V Scale	DIV
	V Zoom	×1
	Offset	0.0 V
	Invert	OFF
	Linear Scale	OFF
CH1 to 16 (HS1M16 (701251))		
	V/div	50.0 V/div
	Position	0.00 div
	Label	Channel number
	Coupling	DC
	Probe	10:1
	BandWidth	Full
	V Scale	DIV
	V Zoom	×1
	Offset	0.00 V
	Invert	OFF
	Linear Scale	OFF
CH1 to 16 (NONISO_10M12 (701255))		
	V/div	50.0 V/div
	Position	0.00 div
	Label	Channel number
	Coupling	DC
	Probe	10:1
	BandWidth	Full
	V Scale	DIV
	V Zoom	×1
	Offset	0.0 V
	Invert	OFF
	Linear Scale	OFF
CH1 to 16 (HV (with RMS) (701267))		
	V/div	5.000 V/div
	Position	0.00 div
	Label	Channel number
	Coupling	DC
	Probe	1:1
	BandWidth	Full
	V Scale	DIV
	V Zoom	×1
	Offset	0.000 V
	Invert	OFF
	Linear Scale	OFF
CH1 to 16 (UNIVERSAL (701261)/UNIVERSAL (AAF) (701262))		
	V/div	5.000 V/div
	Position	0.00 div
	Label	Channel number
	Coupling	DC
	BandWidth	Full
	V Scale	DIV
	V Zoom	×1
CH1 to 16 (UNIVERSAL (701261)/UNIVERSAL (AAF) (701262))		
	Offset	0.000 V
	Invert	OFF
	Linear Scale	OFF
CH1 to 16 (TEMP/HPV (701265))		
	V/div	5.000 V/div
	Position	0.00 div
	Label	Channel number
	Coupling	DC
	BandWidth	Full
	V Scale	DIV
	V Zoom	×1
	Offset	0.000 V
	Invert	OFF
	Linear Scale	OFF
CH1 to 16 (STRAIN_NDIS (701270)/STRAIN_DSUB (701271))		
	Value/div	4000.0 μSTR/div
	Range	±20000 μSTR
	Label	Channel number
	Excitation	2 V
	Gauge Factor	2.00
	BandWidth	Full
	Upper	20000 μSTR
	Lower	–20000 μSTR
	Range Unit	μSTR
	Invert	OFF
	Linear Scale	OFF
CH1 to 16 (ACCL/VOLT (701275))		
	V/div	50.0 V/div
	Position	0.00 div
	Label	Channel number
	Coupling	DC
	Probe	10:1
	BandWidth	Full
	V Scale	DIV
	V Zoom	×1
	Offset	0.00 V
	Invert	OFF
	Linear Scale	OFF
CH1 to 16 (FREQ (701280))		
	Value/div	1 kHz/div
	Position	0.00 div
	Label	Channel number
	FV Setup	Frequency
	Input Setup	User
	V Scale	DIV
	V Zoom	×1
	Offset	0.000 Hz
	Linear Scale	OFF
CH1 to 16 (HS100M12 (720210))		
	V/div	50.0 V/div
	Position	0.00 div
	Label	Channel number
	Coupling	DC
	Probe	10:1
	BandWidth	Full

Operation Key	Soft Key	Setting
	V Scale	DIV
	V Zoom	×1
	Offset	0.0 V
	Invert	OFF
	Linear Scale	OFF
CH1 to 16 (16CH VOLT (720220))		
	V/div	2.000 V/div
	Position	0.00 div
	Label	Channel number
	Coupling	DC
	BandWidth	Full
	V Scale	DIV
	V Zoom	×1
	Offset	0 mV
	Invert	OFF
	Linear Scale	OFF
CH1 to 16 (16CH VOLT (720221))		
	V/div	2.000 V/div
	Position	0.00 div
	Data Update Period	100 ms
	Label	Channel number
	Coupling	DC
	V Scale	DIV
	V Zoom	×1
	Offset	0.0 mV
	Invert	OFF
	Linear Scale	OFF
CH1 to 16 (LOGIC (720230))		
	Position	0.00 div
	Label	Channel number
	Bit Mapping	Auto
CH13 to 16 (CAN MONITOR (720240))		
	All SubChannels Setup	
	Input	OFF
	Label	Channel number
	Message Format	STD
	ID (Hex)	000
	Byte Count	Auto
	Start Bit	0
	Bit Count	8
	Byte Order	Big
	Value Type	Unsigned
	Factor	1.0000
	Offset	0.0000
	Port Setup	
	Bit Rate	500 Kbps
	Sample Point	85%
	Sync Jump Width	2
	Bit Sample Num	1
	Listen Only	OFF
	Terminator	OFF
	Scale	Auto
	One Shot Out	
	Message Format	STD
	ID (Hex)	000
	Frame	Data
	DLC	0
	Data (Hex)	00 00 00 00 00 00 00 00

Operation Key	Soft Key	Setting
CH13 to 16 (CAN & LIN (720241))		
	The values for CAN are the same as the values for the 720240.	
	All SubChannels Setup	
	Input	OFF
	Label	Channel number
	ID (Hex)	000
	Start Bit	0
	Bit Count	8
	Byte Order	Little
	Value Type	Unsigned
	Factor	1.0000
	Offset	0.0000
	Port Setup	
	Bit Rate	19200 bps
	Frame Setup	
	Data Length	1
	Check Sum	Classic
	Scale	Auto
START/STOP		
		STOP
TIME/DIV		
		1 ms/div
ACQUIRE		
	Record Length	10 k
	Acquisition Mode	Normal
	Trigger Mode	Auto
	Acquisition Count	Infinite
	HD Recording	OFF
	Time Base	Int
DUAL CAPTURE		
	Mode	OFF
	Capture Setup	
	Time/div	100 μs/div
	Capture Length	10 k
	Capture Mode	Auto
	Select Number	Current
	Mag	100 μs/div
	Position	0.0 div
	Window	ON
	Main Ratio	50%
	Window Layout	Side
	Format	Main
	Event Display	OFF

Operation Key	Soft Key	Setting
FILE		
	Save_Waveform	
	Auto Naming	Numbering
	Data Type	Binary
	Range	Main
	Save_Setup	
	Auto Naming	Numbering
	Save_Others	
	Auto Naming	Numbering
	Data Type	Screen Image
	Format	PNG
	Color	ON
MENU		
	Waveform Save	ON
	Waveform Save Setup	
	Auto Naming	Numbering
	Data Type	Binary
	Image Save	OFF
	Image Save Setup	
	Auto Naming	Numbering
	Image Format	PNG
	Color	ON
	Back Ground	Normal
DISPLAY		
	Format	Quad
	Extra Window	OFF
	Graticule	Grid
	Scale Value	ON
	Setup	
	Allocation Mode	Auto
	Trace Label	OFF
	Dot Connect	Line
	Accumulate	OFF
	Manual Event	OFF
	Ch. Information	Narrow
X-Y		
	Window1/2	OFF
	Display	OFF
	Start Point	–5 div
	End Point	5 div
MODE		
		Auto
POSITION/DELAY		
	Position	50.0%
	Delay	0.0 μs
SIMPLE/ENHANCED		
	Setting	Simple
	Source	CH1
	Slope	Rising
	Level	0 V
	Hold Off	0.00 μs

Operation Key	Soft Key	Setting
CURSOR		
	Type	OFF
	Horizontal	
	Trace	CH1
	Cursor1	3.00 div
	Cursor2	–3.00 div
	Vertical	
	Trace	CH1
	Cursor1	–4.000 div
	Cursor2	4.000 div
	Marker	
	Marker #	Marker1 X
	Trace	CH1
	Position	–3.000 div
	Marker From	Mark
	Degree	
	Trace	CH1
	Cursor1	–4.000 div
	Cursor2	4.000 div
	RefValue	360
	Ref1	–2.000 div
	Ref2	2.000 div
	H & V	
	Trace	CH1
	V-Cursor1	–4.000 div
	V-Cursor2	4.000 div
	H-Cursor1	3.00 div
	H-Cursor2	–3.00 div
MEASURE		
	Mode	OFF
	Distal/Mesial/Proximal	
	Mode	%
	Distal	90.0%
	Mesial	50.0%
	Proximal	10.0%
	High/Low	Auto
	Delay Setup	
	Mode	OFF
	Polarity	Rising
	Edge Count	1
	Reference	Trace
	Range	Main
	Time Range1	–5.00 div
	Time Range2	5.00 div
	(When Mode is set to ON, Statistics)	
	1-Cycle Mode	OFF
	(When Mode is set to Cycle Statistics)	
	Cycle Trace	CH1

Operation Key	Soft Key	Setting
GO/NO-GO		
	Mode	OFF
	Logic	AND
	ActCondition	Fail
	Sequence	Continue
	Acquisition Count	Infinite
	Remote	OFF
	Beep	OFF
	Print Image	OFF
	Save Waveform	OFF
	Save Image	OFF
	Send Mail	OFF
	Time Range1	–5.00 div
	Time Range2	5.00 div
HISTORY		
	Display Mode	1 Record
	Select Record	0
	Start Record	0
	End Record	Oldest number
	Search Mode	OFF
MATH		
	Mode	OFF
	Select Math Trace	1
	Opeartion:Math1	OFF
	Opeartion:Math2	OFF
	Opeartion:Math3	OFF
	Opeartion:Math4	OFF
	Opeartion:Math5	OFF
	Opeartion:Math6	OFF
	Opeartion:Math7	OFF
	Opeartion:Math8	OFF
	Scaling Mode	Auto
	Start Point	–5.00 div
	End Point	5.00 div
	FFT Points	1 k
	Window	Hanning
FFT		
	Display	OFF
	Trace	CH1
	Start Point	–5.00 div
	FFT Points	1 k
	Window	Hanning
	Vert. Scale Mode	Auto
	Main Ratio	50%
	Window Layout	Side
	Horiz. Axis	Log Hz
ZOOM		
	Display (Zoom1)	ON
	Display (Zoom2)	OFF
	Position	0.00 div
	Main Ratio	50%
	Window Layout	Side
	Format Zoom1	Main

Operation Key	Soft Key	Setting
SEARCH		
	Type	Edge
	Edge	
	Trace	CH1
	Level	0.0 V
	Polarity	Rising
	Hysteresis	≁
	Count	1
	Result Window	Zoom1
	Pattern No.	No Match
	Event	
	Select Number	1
	Result Window	Zoom1
	Select Event	Capture
	Logic Pattern	
	Trace	Installation channel
	Bit Setting	X
	Result Window	Zoom1
	Pattern No.	No Match
	Start Point	–5.00 div
	End Point	5.00 div
	Time	
	Absolute Time	Current date and time
	Result Window	Zoom1
PRINT MENU		
	Print To	Builtin
UTILITY		
	System Config	
	Date/Time	
	Display	ON
	Format	Year/Month/Day
	Time Synchro	
	Time Synchro	OFF
	IRIG Format	A
	Modulation	AM
	Impedance	50
	Language	
	Menu	English
	Message	English
	LCD	
	Auto OFF	OFF
	Auto OFF Time	1 min
	Brightness	3
	Storage Manager	
	Media	HD
	USB Keyboard	English
	USB Function	TMC
	Remote Ctrl	
	Device	USB
	USB Function	TMC
	Network	
	TCP/IP	
	DHCP	ON
	DNS	Auto
	FTP/Web Server	
	User Name	anonymous
	TimeOut(s)	1800
	TimeOut (s)	15

Operation Key	Soft Key	Setting
	Mail	
	Attached Image File	OFF
	TimeOut (s)	15
	Net Print	
	LPR Name	PASSTHRU
	TimeOut (s)	15
	Net Drive	
	LoginName	anonymous
	Passive	OFF
	TimeOut (s)	1800
	SNTP	
	TimeOut (s)	3
	Adjust at PowerON	OFF
	Preference	
	Power On Action	
	Start	OFF
	Action	OFF
	Logic Setup	
	Numerical Format	Bit
	Cursor Order	1 -> 8
	Bit Order	1 -> 8
	Terminal Setup	
	Remote Stop	On
	Trigger Out	Normal
	Pulse Width	1 msec
	Display Setup	
	Menu Font Size	Large
	Base Color	Blue
	Scale Font Size	Large
	Scale On Item	All
	Level Indicator	On
	Horozontal Axis Display Mode	Auto
	Intensity	
	Grid	2
	Cursor	8
	Marker	8
	Key/Knob Setup	
	Click Sound	ON
	START/ STOP Response Time	Quick
	Key Protect	
	Type	All
	Release Type	Key
	Analysis Setup	
	Cursor Read Mode	Display
	Action Folder Mode	ON
	Input Setup DC Offset & Adjust	OFF
	Self Test	Keyboard

Appendix 4 USB Keyboard Key Assignments

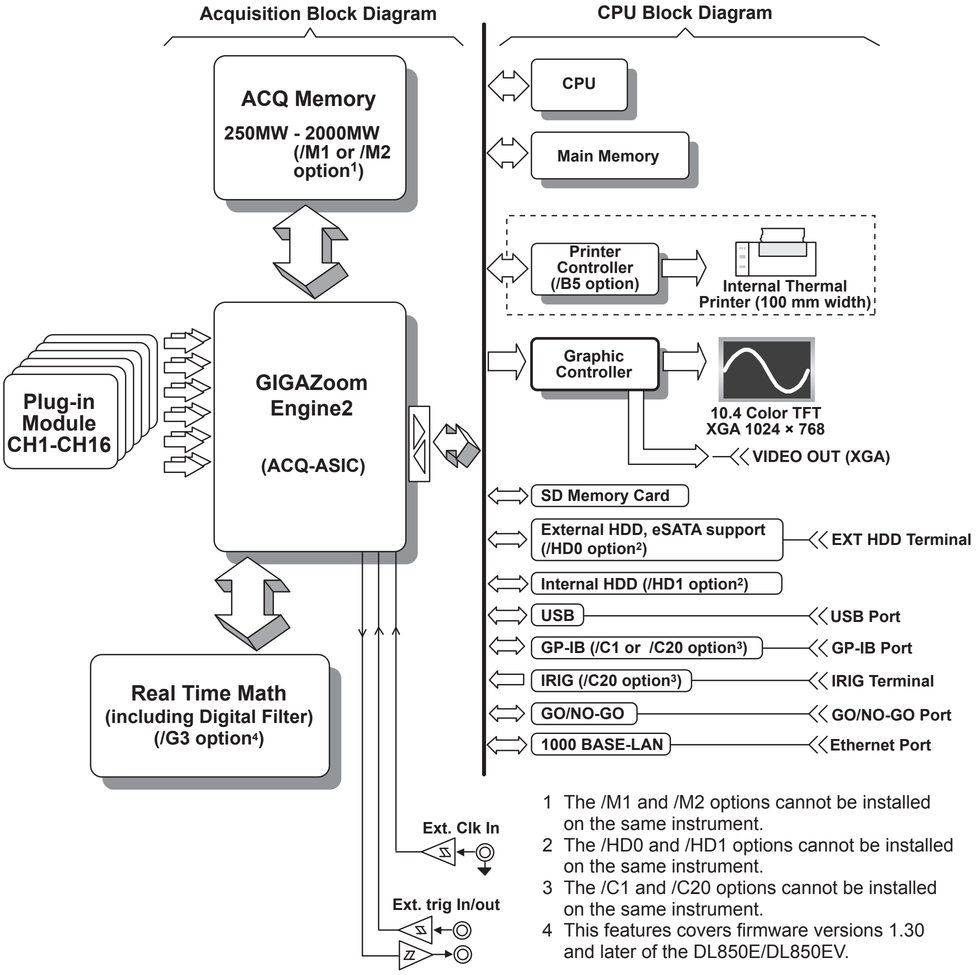
DL850E/DL850EV	USB Keyboard
AQUIRE	CTRL+A
MATH	CTRL+B
Execute PRINT	CTRL+C or PRINT SCREEN
DISPLAY	CTRL+D
FILE	CTRL+F
HELP	CTRL+G
HISTORY	CTRL+H
Execute SAVE	CTRL+I
MANUALTRIG	CTRL+J
KEY PROTECT	CTRL+K
ALL CH	CTRL+L
MEASURE	CTRL+M
NUM LOCK	CTRL+N
POSITION/DELAY	CTRL+P
Execute CLEAR TRACE	CTRL+Q
Execute RESET	CTRL+R
SHIFT	CTRL+S
MODE (TRIGGER)	CTRL+T
CURSOR	CTRL+U
ANALYSIS	CTRL+X
SIMPLE/ENHANCED	CTRL+W
ZOOM	CTRL+Z
CH1	CTRL+1
CH2	CTRL+2
CH3	CTRL+3
CH4	CTRL+4
CH5	CTRL+5
CH6	CTRL+6
CH7	CTRL+7
CH8	CTRL+8
CH9	CTRL+9
CH10	CTRL+0
SET	CTRL+ENTER
SETUP	CTRL+\
UTILITY	CTRL+/
CH11	CTRL+F1
CH12	CTRL+F2
CH13	CTRL+F3
CH14	CTRL+F4
CH15	CTRL+F5
CH16	CTRL+F6
Turn ZOOM POSITION to the right	CTRL+INSERT
Turn VERTICAL POSITION to the right	CTRL+HOME
Turn ZOOM POSITION to the left	CTRL+DELETE
Turn VERTICAL POSITION to the left	CTRL+END
START/STOP	CTRL+* or F12
DUAL CAPTURE	CTRL+SHIFT+A
FFT	CTRL+SHIFT+B
PRINT MENU	CTRL+SHIFT+C
X-Y	CTRL+SHIFT+D
MENU	CTRL+SHIFT+I
GO/NO-GO	CTRL+SHIFT+M
ACTION	CTRL+SHIFT+T
SEARCH	CTRL+SHIFT+Z
CAL	CTRL+SHIFT+\
EXP (CH key)	E when NUM LOCK is illuminated on the DL850E/DL850EV

Appendix 4 USB Keyboard Key Assignments

DL850E/DL850EV	USB Keyboard
k (CH key) + ENTER (CH key)	K when NUM LOCK is illuminated on the DL850E/ DL850EV
m (CH key) + ENTER (CH key)	M when NUM LOCK is illuminated on the DL850E/ DL850EV
1 (CH key)	1 when NUM LOCK is illuminated on the DL850E/ DL850EV
2 (CH key)	2 when NUM LOCK is illuminated on the DL850E/ DL850EV
3 (CH key)	3 when NUM LOCK is illuminated on the DL850E/ DL850EV
4 (CH key)	4 when NUM LOCK is illuminated on the DL850E/ DL850EV
5 (CH key)	5 when NUM LOCK is illuminated on the DL850E/ DL850EV
6 (CH key)	6 when NUM LOCK is illuminated on the DL850E/ DL850EV
7 (CH key)	7 when NUM LOCK is illuminated on the DL850E/ DL850EV
8 (CH key)	8 when NUM LOCK is illuminated on the DL850E/ DL850EV
9 (CH key)	9 when NUM LOCK is illuminated on the DL850E/ DL850EV
0 (CH key)	0 when NUM LOCK is illuminated on the DL850E/ DL850EV
ENTER (CH key)	ENTER when NUM LOCK is illuminated on the DL850E/ DL850EV
. (CH key)	. when NUM LOCK is illuminated on the DL850E/ DL850EV
– (CH key)	– when NUM LOCK is illuminated on the DL850E/ DL850EV
ESC	ESC or F8
Select soft key 1	F1
Select soft key 2	F2
Select soft key 3	F3
Select soft key 4	F4
Select soft key 5	F5
Select soft key 6	F6
Select soft key 7	F7
SNAPSHOT	PAUSE
Turn ZOOM MAG to the right	INSERT
Turn VERTICAL SCALE to the right	HOME
Turn HORIZONTAL TIME/DIV to the right	PAGE UP
Turn ZOOM MAG to the left	DELETE
Turn VERTICAL SCALE to the left	End
Turn HORIZONTAL TIME/DIV to the left	PageDown
Right arrow	→
Left arrow	←
Up arrow	↑
Down arrow	↓

Appendix 5 Block Diagrams

Block Diagram of the DL850E/DL850EV


Acquisition Block Diagram
CPU Block Diagram
ACQ Memory
250MW - 2000MW (/M1 or /M2 option1)
Plug-in Module CH1-CH16
GIGAZoom Engine2
(ACQ-ASIC)
Real Time Math (including Digital Filter) (/G3 option4)
Ext. Clk In
Ext. trig In/out
CPU
Main Memory
Printer Controller (/B5 option)
Internal Thermal Printer (100 mm width)
Graphic Controller
10.4 Color TFT XGA 1024 × 768
VIDEO OUT (XGA)
SD Memory Card
External HDD, eSATA support (/HD0 option2)
EXT HDD Terminal
Internal HDD (/HD1 option2)
USB
USB Port
GP-IB (/C1 or /C20 option3)
GP-IB Port
IRIG (/C20 option3)
IRIG Terminal
GO/NO-GO
GO/NO-GO Port
1000 BASE-LAN
Ethernet Port

1 The /M1 and /M2 options cannot be installed on the same instrument.
2 The /HD0 and /HD1 options cannot be installed on the same instrument.
3 The /C1 and /C20 options cannot be installed on the same instrument.
4 This features covers firmware versions 1.30 and later of the DL850E/DL850EV.

Signal Flow of the DL850E/DL850EV

The input terminal signal flow varies for each model. In this example, we will explain the signal flow for the High-Speed 10 MS/s, 12-Bit Isolation Module, 701250 (HS10M12). (For the signal flow of a particular module, see the module’s block diagram.)

The input signal applied to the two input terminals is first processed by each module’s input section. In the 701250 (HS10M12), the signal is attenuated and amplified by an attenuator (ATT) and amplifier (AMP). Then, the signal’s bandwidth is limited by a filter (FLT). Next, the signal is sampled at a rate of 10 MS/s (10,000,000 times a second) by an A/D converter and converted into digital data. Then, the signal passes through an isolator and an ASIC to a waveform-processing ASIC (ACQ-ASIC).

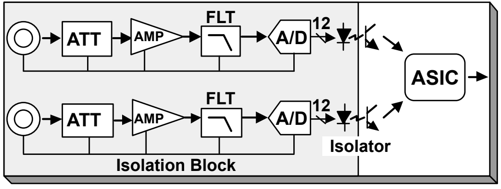
The 16 channel of digital data that is sent to the CPU board passes through the GIGAZoom Engine2 waveform processor and is stored to the acquisition memory (ACQ Memory). The digital data stored to the ACQ memory is compressed quickly by the GIGAZoom Engine2, and then it passes through a graphic controller and is shown on the XGA TFT color display.

The realtime math feature (/G3 option) uses the A/D converted data of the analog input channels or the math results of realtime math channels or both as its math sources and performs math operations on the specified channels in real time.

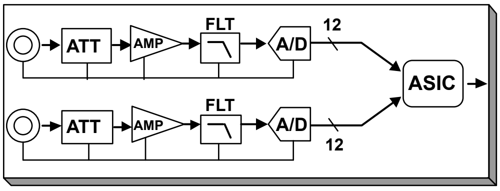
You can use the DL850E/DL850EV to perform realtime math on up to 16 channels at the same time.

Plug-in Module Block Diagram

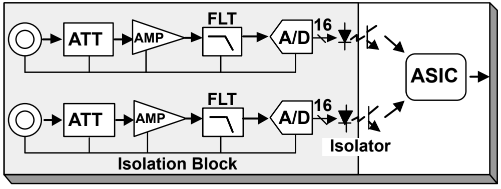
701250 (HS10M12)


ATT
AMP
FLT
A/D
12
ASIC
ATT
AMP
FLT
A/D
12
Isolator
Isolation Block

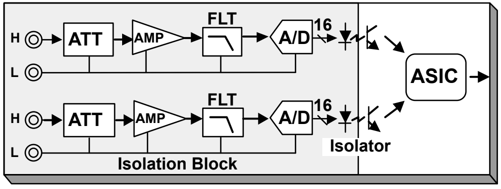
701255 (NONISO_10M12)


ATT
AMP
FLT
A/D
12
ASIC
ATT
AMP
FLT
A/D
12

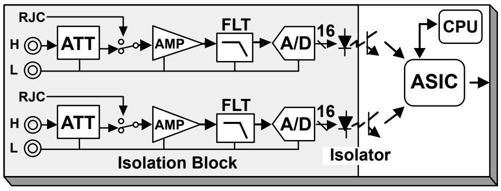
701251 (HS1M16)


ATT
AMP
FLT
A/D
16
ASIC
ATT
AMP
FLT
A/D
16
Isolator
Isolation Block

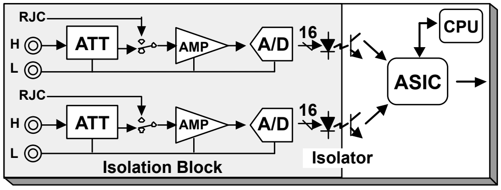
701267(HV(with RMS))


H
L
ATT
AMP
FLT
A/D
16
ASIC
H
L
ATT
AMP
FLT
A/D
16
Isolator
Isolation Block

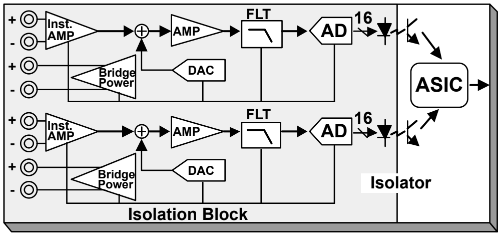
701261 (UNIVERSAL)
701262 (UNIVERSAL (AAF))


RJC
H
L
ATT
AMP
FLT
A/D
16
CPU
ASIC
RJC
H
L
ATT
AMP
FLT
A/D
16
Isolator
Isolation Block

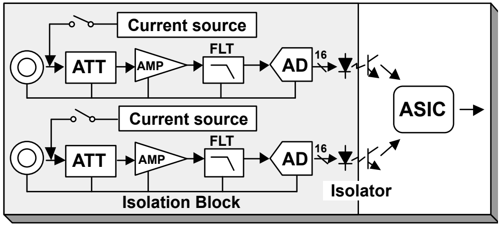
701265 (TEMP/HPV)


RJC
H
L
ATT
AMP
A/D
16
CPU
ASIC
RJC
H
L
ATT
AMP
A/D
16
Isolator
Isolation Block

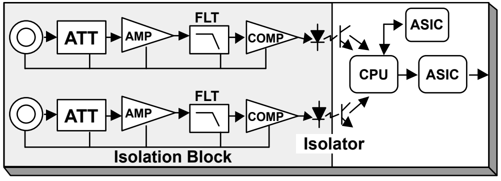
701270 (STRAIN_NDIS)
701271 (STRAIN_DSUB)


+
-
Inst. AMP
AMP
FLT
AD
16
+
-
Bridge Power
DAC
ASIC
+
-
Inst. AMP
AMP
FLT
AD
16
+
-
Bridge Power
DAC
Isolator
Isolation Block

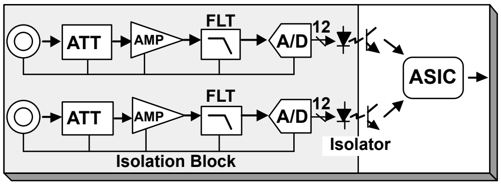
701275 (ACCL/VOLT)


Current source
ATT
AMP
FLT
AD
16
ASIC
Current source
ATT
AMP
FLT
AD
16
Isolator
Isolation Block

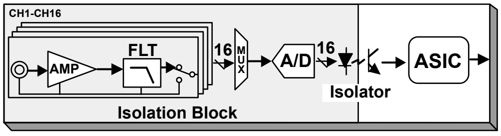
701280 (FREQ)


ATT
AMP
FLT
COMP
ASIC
CPU
ASIC
ATT
AMP
FLT
COMP
Isolator
Isolation Block

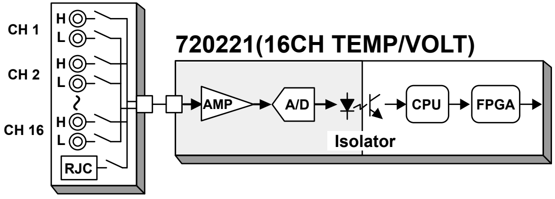
720210 (HS100M12)


ATT
AMP
FLT
A/D
12
ASIC
ATT
AMP
FLT
A/D
12
Isolator
Isolation Block

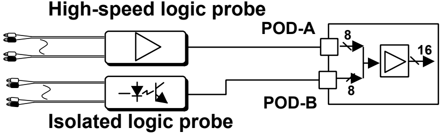
720220 (16CHVOLT)


CH1-CH16
AMP
FLT
16
MUX
A/D
16
ASIC
Isolator
Isolation Block

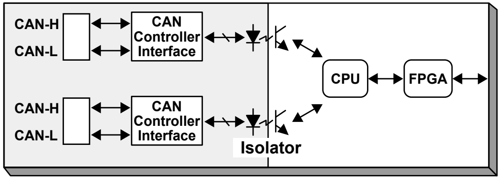
701953(16CH SCANNER BOX)
720221(16CH TEMP/VOLT)


CH 1
H
L
CH 2
H
L
CH 16
H
L
RJC
AMP
A/D
CPU
FPGA
Isolator

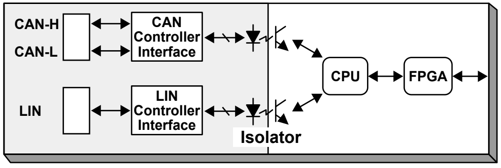
720230 (LOGIC)


High-speed logic probe
POD-A
8
16
8
POD-B
Isolated logic probe

720240 (CAN MONITOR)


CAN-H
CAN-L
CAN Controller Interface
CPU
FPGA
CAN-H
CAN-L
CAN Controller Interface
Isolator

720241(CAN & LIN)


CAN-H
CAN-L
CAN Controller Interface
CPU
FPGA
LIN
LIN Controller Interface
Isolator

Appendix 6 High-Voltage 100 kS/s, 16-Bit Isolation Module (with RMS) (701260) Specifications

The specifications for the High-Voltage 100 kS/s, 16-Bit Isolation Module (with RMS) (701260) are provided below. This input module (701260) will not comply with safety standard EN61010-1 or EN61010-2-030 after September 30, 2013.

Item	Specifications
Standard operating conditions	Temperature: 23 ±5°C Humidity: 20 to 80% RH After a 30-minute warm-up and after calibration
Effective measurement range	20 div (±10 div around 0 V, display range: 10 div, when Variable is OFF)
Number of input channels	2
Input coupling	AC, DC, GND, AC-RMS, and DC-RMS
Maximum sample rate	100 kS/s
Input format	Isolated unbalanced
Frequency characteristics[1] (−3 dB point when a sine wave of amplitude ±3 div is applied)	Waveform observation mode: DC to 40 kHz RMS observation mode: DC, 40 Hz to 10 kHz
Voltage-axis sensitivity setting	20 mV/div to 200 V/div (1-2-5 steps) (when using 1:1 probe attenuation)
Maximum input voltage (at a frequency of 1 kHz or less)	Combined with the 700929(10:1) or 701947 (100:1):[2] 1000 V (DC+ACpeak) Combined with the 701901+701954 (1:1):[5] 850 V (DC+ACpeak) Direct input or cable not complying with the safety standard:[8] 850 V (DC+ACpeak)
Maximum allowable common mode voltage (at a frequency of 1 kHz or less)	Working voltage of safety standard Combined with the 700929 or 701947 (across probe tip H and earth[3]): 1000 Vrms (CAT II) (across probe tip L and earth[4]): 400 Vrms (CAT II) Combined with the 701901+701954 (1:1) (across tip H and earth[6]): 700 Vrms (CAT II) (across tip L and earth[7]): 400 Vrms (CAT II) Direct input or cable not complying with the safety standard:[9] 30 Vrms (42 VDC+ACpeak) (across the input terminal, H or L, and earth)
Vertical (voltage) axis accuracy DC accuracy[1]	Waveform observation mode DC accuracy ±(0.25% of 10 div) RMS observation mode DC accuracy ±(1.0% of 10 div) AC accuracy (when a sine wave is input) ±(1.5% of 10 div) At frequency of 40 Hz to 1 kH AC accuracy (when the crest factor is 2 or less) ±(2.0% of 10 div) At frequency of 40 Hz to 1 kH AC accuracy (when the crest factor is 3 or less) ±(3.0% of 10 div) At frequency of 40 Hz to 1 kH
Input connector	BNC connector (isolated type)
Input impedance	1 MΩ ± 1%, approx. 35 pF
−3 dB point when AC coupled low frequency attenuation point	1 Hz or less (0.1 Hz or less when using the 700929, 0.01 Hz or less when using the 701947)
Common mode rejection ratio	80 dB (50/60 Hz) or more (Typical[10])
Residual noise level (Input section shorted)	±1 mV or ±0.02 div whichever is greater (Typical[10])
Withstand voltage	3700 Vrms for 1 minute (across each terminal and earth) (60 Hz)
Allowable transient surge voltage (instantaneous)	±5200 Vpeak (across each input terminal and earth)
Insulation resistance	500 VDC, 10 MΩ or more (across each input terminal and earth)
A/D conversion resolution	16 bit (2400 LSB/div)
Temperature coefficient	Zero point: ±(0.02% of 10 div)/°C(Typical[10]) Gain: ±(0.02% of 10 div)/°C(Typical[10])
Response time (only when observing RMS)	Rising (0 to 90% of 10 div): 100 ms (Typical[10]) Falling (100 to 10% of 10 div): 250 ms (Typical[10])
Bandwidth limit	Select from OFF, 10 kHz,1 kHz, and 100 Hz Cut-off characteristics: −12 dB/OCT (Typical[10])
Probe attenuation setting	Voltage probe: 1:1, 10:1, 100:1, 1000:1 Current probe: 10 A:1 V (for the 700937/701933), 100 A: 1 V (for the 701930/701931)

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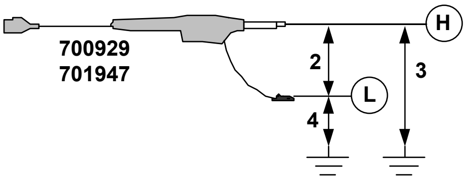
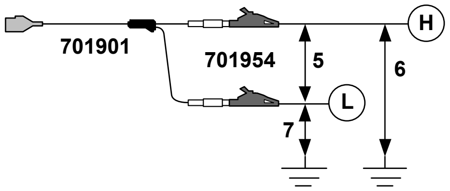
Item	Specifications
Compatible probes/ cables	Connection cable (for high voltage 1:1): Recommended 1 701901 (isolated type BNC-safety alligator clip adapter ×2: For measuring 850 V (DC+ACpeak) or less), 701954 (alligator clip (dolphin type) red/black 2-piece set) is required separately Voltage probe: Recommended 2 700929 (10:1 safety probe).20 to 45 pF: For measuring 1000 Vpeak or less 701947 (100:1 probe).15 to 45 pF: For measuring 1000 Vpeak or less Current probe (power can be supplied from the DL850E/DL850EV. Option) 700937 (15 A), 701930 (150 A), 701931 (500 A), 701933 (30 A)

1 Value measured under standard operating conditions.

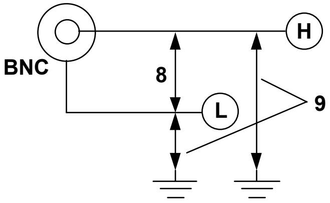
Combined with the 700929 or 701947



Combined with the 701901+701954



Direct input (cable that does not comply with the safety standards)



Withstand voltage: 3700 Vrms for 1 minute
Allowable transient surge voltage: ±5200 Vpeak
(between earth and input)

10 The typical value is a representative or standard value. It is not strictly warranted.

WARNING

- When applying high voltage using this module, use the 1:1 safety cable (combination of 701901 and 701954) or the isolated probe (700929 or 701947).
- Note that the overvoltage tolerance of the low and high sides of this module may differ depending on the combination of the connected probe, measurement lead, and clip.
- Do not apply input voltage exceeding the maximum input voltage, withstand voltage, or allowable surge voltage.
- To prevent the possibility of electric shock, be sure to furnish protective earth grounding of the DL850E/DL850EV.
- To prevent the possibility of electric shock, be sure to fasten the module screws. Otherwise, the electrical and mechanical protection functions will not be activated.
- Avoid continuous connection under an environment in which the surge voltage may occur.